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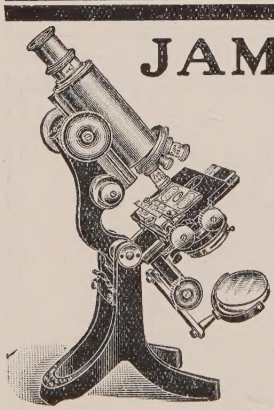

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

Vol. I.] 1913. [No. 11.

RELAPSING FEVER.

NUTTALL (George H. F.). **The Herter Lectures. 1. Spirochaetosis.** [Lecture delivered on the Herter Foundation, Johns Hopkins University, Baltimore, Maryland, U.S.A., 8 October 1912.] —*Parasitology.* 1913. Jan. Vol. 5. No. 4. pp. 262-274; also in *Bulletin of the Johns Hopkins Hospital.* 1913. Feb. Vol. 24. No. 264. pp. 33-39.

This article contains a short summary of the present state of our knowledge of the blood spirochaetes, together with an account of their mode of transmission and cultivation.

The paper should be read in its entirety by anyone desirous of a condensed account of this important group of parasites, but attention may be called to one or two original observations. Thus, referring to the extension of the relapsing fever of Tropical Africa, the author points out that the distribution of the intermediate host, *Ornithodorus moubata,* is far wider than that of the infection it carries, and there is every reason to fear that an extension of the fever will follow with time. This contention is supported by a letter from the Rev. John ROSCOE, of Cambridge, who was a missionary in Uganda, where he lived for many years at Kampala in a native-built house having reed walls supported by the usual wooden pillars. To quote the words of this gentleman:

"Some of the pillars were in rooms, not in the walls, and it was at the bases of two of these pillars in the room used as a dining-room that I noticed the ticks in the year 1896 or about that time. For several years I continued to live in the same house and suffered no harm from them. In more recent years, that is, about 1903 or 1904, both Europeans and natives have suffered from 'Tick Fever' (Spirillum) in houses which were built on either side of the site on which my old house stood. It has been affirmed that the ticks in these houses are the cause of the fever; I can only conclude that in previous years they were innocuous and that they have become nocuous since 1896."

Attention is called to the fact that the spirochaete is not specifically adapted to the tick nor the tick to the spirochaete, for a variety of arthropods are capable of transmitting the same spirochaete and also the same arthropod is often able to carry several varieties of spirochaetes. In view of the morphological similarity between the supposedly different species of spirochaetes

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and their individual variations in virulence, we may well doubt if any of the "species" are valid. The various specific names given to the spirochaetes causing relapsing fever in man may be used merely for convenience to distinguish strains or races of different origin.

The author concludes with the following words:—

"To sum up, then, we have represented in the blood-inhabiting spirochaetes of warm-blooded animals a group of micro-organisms which, under natural conditions, are mainly conveyed by blood-sucking ectoparasites within which they undergo a process of development and in which they are hereditarily transmitted. Spirochaetes are not specialized parasites. Infection may take place through the skin or mucous membrane to which the spirochaetes gain access by being deposited thereon in the arthropod's dejecta or by the infested individual scratching or rubbing himself with hands which have become contaminated with the contents of the vermin which they have crushed. The lesions produced by the bites of the arthropods and the excoriations inflicted upon the individual by himself greatly facilitate the entrance of the spirochaetes."

E. Hindle.

Nicolle (Charles) & Blaizot (L.). **Etudes sur la Fièvre Récurrente. Nouveaux Points de l'Etude Expérimentale de la Fièvre Récurrente, du Nord de l'Afrique.**—*Arch. de l'Inst. Pasteur Tunis.* 1912. No. 4. pp. 201-212. With 7 charts.

In the present article the authors continue their study of the relapsing fever of North Africa, especially on the susceptibility of various monkeys and the rabbit. Throughout their experiments a Tripolitan virus was employed.

Hooded monkeys (*bonnets chinois*), when injected intraperitoneally with blood containing spirochaetes, showed parasites in the circulation the following day. After being present for three to four days the spirochaetes disappeared and in the majority of cases there was no relapse. When the virus was passed through rabbits and subsequently inoculated into monkeys, the latter, in three animals out of twenty, showed relapses seven to eight days after the first attack.

Macaques (*Macacus inuus*) were found to be very susceptible to this Tripolitan virus. When injected intraperitoneally with four cc. of heavily infected blood, they showed spirochaetes in the circulation the following day and the parasites remained in the peripheral blood in enormous numbers for about seven days, after which the animals usually died.

The immune serum of recovered monkeys was found to be very effective in preventing infection. Thus a *rhesus* was injected with five cc. of the blood of a monkey that had just recovered from an attack of spirochaetosis and had shown two relapses. Twenty days later the *rhesus* was inoculated with four cc. of very heavily infected blood, but although examined for some weeks the animal never showed any rise in temperature nor spirochaetes in its blood.

The authors also succeeded in infecting examples of *Ctenodactylus gondi*, a rodent that was found to be extremely resistant to spirochaetal infection.

Rabbits were readily infected by the intravenous injection of large quantities of infected blood, and the strain was passed

through twelve rabbits in succession without showing any diminution in virulence. In all cases the parasites attained their maximum about the 48th hour after the inoculation and disappeared from the circulation during the next 24 hours. After passage through ten rabbits one of the authors was accidentally infected with this strain, and the course of the disease showed that the virulence for man was undiminished. As mentioned above, the virulence for the monkey was greatly increased.

In conclusion the authors again call attention to the difficulty of distinguishing the various races of human spirochaetes, especially those belonging to the *recurrentis* group. The three criteria are usually considered to be the receptivity of laboratory animals, cross immunity reactions and the agglutination test. The two former have been shown to be unreliable, and at present the latter is the only means of distinguishing the various species of spirochaetes.

E. H.

Nicolle (Charles) & Blaizot (L.). **Courte Durée de l'Immunité dans la Fièvre Récurrente Expérimentale. Valeur nulle de l'Epreuve de l'Immunité croisée pour la Distinction des Spirochètes du Groupe** *Obermeieri.—Bull. Soc. Path. Exot.* 1913. Feb. Vol. 6. No. 2. pp. 107-110.

The authors again call attention to the uncertainity of distinguishing strains of spirochaetes by their 'crossed immunity' reactions. In the present article they show that monkeys that have recovered from an attack of relapsing fever (Tripolitan strain) may be reinfected with the same virus.

Thus seven monkeys that had recovered from an attack of relapsing fever were subsequently inoculated with the same strain of spirochaetes. Three of these monkeys were still immune against reinfection, although the intervals elapsing since the first attack were respectively nine, seven, and six and a half months. The four remaining monkeys, however, were easily reinfected and suffered from severe attacks of the fever, one of the animals succumbing to the infection. The intervals since recovery from the first attack were respectively eight and a half, seven and a half, less than six, and less than seven months.

The authors state that when the first infection is very intense, there is more chance of a durable immunity being conferred, but the conditions are very uncertain, and it is evident that the crossed immunity reaction is not a safe method of distinguishing the varieties of the *recurrentis* group of spirochaetes.

E. H.

Ross (Philip H.). **Spirillosis.**—*Nairobi Laboratory Report for the Months July-December,* 1911. Vol. 2. Part 2. pp. 6-12. [1912. Nairobi: Printed by the Government Printer.]

It appears that human spirillosis is much more widely spread in British East Africa than had previously been supposed, or that the disease has recently become more disseminated. Additional cases are recorded by the author from Fort Hall, Mweru, and

also one from Nairobi, but in the latter instance the patient was living in a shop that dealt in native foodstuffs and it is probable that ticks had been introduced with them. Two other rather doubtful cases are recorded from Marsabit and *O. moubata* has been found at various localities along the road from Marsabit to the northern Guasi Nyiro.

The author attempted to determine, by means of immunity reactions, whether the Kenia strain (from Fort Hall) of spirochaetes was the same as one from Uganda. Monkeys were inoculated with the respective strains, but usually they died and those few that recovered could all be reinfected by a second inoculation of the same strain of spirochaetes. As a result no conclusive results were obtained regarding the possible distinctness of the two strains.

The virulence of the strain of spirochaetes employed by the author has, if anything, been increased by passage through monkeys (Sykes' *Cercopithecus*). In spite of its virulence, however, recovery from an attack of the 'Kenia' spirochaete is not followed by any appreciable degree of active immunity.

The report is accompanied by tables showing the results of inoculation experiments with two strains of spirochaetes from East Africa and one from Uganda, respectively.

E. H.

GLEITSMANN. **Beitrag zur Entwickelungsgeschichte der Spirochäten (Borrelien).** [The Life-history of Spirochaetes (Borrelia).]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Feb. Vol. 68. No. 1. pp. 31-49. With 1 plate and 2 text-figures.

The author has studied two strains of fowl spirochaetes, one from the Sudan and the other from Brazil, with especial reference to the nature of the so-called 'intra-corpuscular bodies,' described by BALFOUR as constituting part of the life-cycle of the Sudanese fowl spirochaete. The immunity reactions of the two strains were compared and found to differ *in vitro*. Thus serum immune against the Sudan spirochaete arrested all motion in this strain of spirochaetes more rapidly than in the Brazilian strain and *vice versâ*. Nevertheless, a fowl which had acquired immunity against one strain was also immune against the other, and therefore the two must be very closely related.

The remainder of the paper deals with the nature of BALFOUR'S bodies, and the author inclines to the belief that they are degeneration products produced by the toxins of the spirochaetes, though they may represent some independent infection. Particulars are given of the course of the infection in nine fowls and five chickens. Three of the fowls infected with the Sudan strain and one with the Brazilian strain showed chronic symptoms characterised by anaemia, diarrhoea, and the emission of a very foul odour. In no case, however, was the relapse associated with the presence of either spirochaetes or BALFOUR'S bodies. When the parasites were numerous in the peripheral circulation, the blood-cells sometimes presented an appearance identical with that produced by an injection of some haemolytic poison, such as phenylhydrazine. Under these conditions the nuclei of the red cells underwent karyolysis and gave off deeply staining bodies

into the cytoplasm. In addition the spirochaetes were observed to penetrate into the red cells without, however, undergoing any changes in them.

[The results of Gleitsmann's observations tend to confirm the view that Balfour's bodies do not represent any stage in the life cycle of the spirochaete. In some cases the author gives incorrect references: thus Luhs is spelt "Luss," and the reference to Hindle's paper is given as *Ann. Trop. Med. & Parasit,* instead of *Parasitology,* Vol. 4, No. 4.]

E. H.

Epidemiological.

Millous. **Les Epidémies Fébriles non classées et la Fièvre Récurrente dans le Thanh-hoa en 1910, 1911, et 1912.**—*Bull. Soc. Méd.-Chirurg. de l'Indochine.* 1913. Jan. Vol. 4. No. 1. pp. 14-18.

In 1910 and 1911 during the spring and autumn months epidemics of relapsing fever occurred in various parts of the province of Thanh-hoa, Annam, especially in the north. These epidemics were remarkable for the high mortality, about 500 deaths being recorded by the native authorities.

Over 2000 blood films were examined without finding any spirochaetes, and repeated Widal's also gave negative results.

In March 1912, epidemics of relapsing fever broke out suddenly in various distinct parts of the province, and in the blood of the patients spirochaetes were found without any difficulty.

The affection was remarkable for its severity, four deaths out of five cases before the employment of salvarsan, and even with this drug, if the treatment was commenced too late, the patients often succumbed. In most cases the fever was of the typho-bilious type (see this *Bulletin* No. 7, p. 385).

The author obtained very good results by the employment of intravenous and subcutaneous injections of salvarsan. Very small doses, not exceeding 0·15 gm., were invariably used. In five patients the drug was administered per rectum, but in no case had it any effect on the course of the disease. Thus one patient succumbed although he had absorbed 0·5 gm. of salvarsan per rectum, more than four times the curative dose administered intravenously. The intra-rectal method of administration, therefore, should not be employed. [Compare the results of Mouzels and Nguyen-Xuan-Mai, see this *Bulletin* No. 1, p. 35.]

In conclusion the author remarks on the small size of the spirochaetes causing this outbreak of relapsing fever. They were only nine to fifteen microns in length, with three to four spires, and were so excessively fine that it was very difficult to detect them except in very clean preparations.

The limitation of the fever to a number of relatively restricted and isolated regions, and its simultaneous appearance and disappearance in all parts of the province is very remarkable. The possibility of the existence of reservoirs of the virus is supported by Millous' observation, contained in a postscript to the article, that the examination of the blood of 600 persons in one of the districts that had recovered from an epidemic, revealed the presence of two isolated cases of the fever.

E. H.

Dschunkowsky (E.). **Das Rückfallfieber in Persien.** [Relapsing Fever in Persia.]—*Deut. Med. Wochenschr.* 1913. Feb. 27. Vol. 39. No. 9. pp. 419-420; also (in Russian) in *Med. Obozr.*, Moskow. 1912. Vol. 77. pp. 995-1005. With 3 plates and 1 table. [Cited in *Index Medicus.*]

The presence of relapsing fever in Persia has been suspected for many years, but the author is the first to bring forward definite evidence that a spirochaetal infection, closely allied to the relapsing fever of Africa, occurs in this country.

Dr. A. P. Wosnissensky recently sent a number of ticks to the author, together with an account of the ill effects in human beings that resulted from their bites. "Two days after the bite an irritation commences; a copper-coloured spot appears, which later becomes raspberry- and violet-coloured, from the size of a pin's head to that of a lentil; by the end of the fifth day the irritation is very considerable and the scratching of the spot results in the formation of bloody crusts. On the evening of the fifth day the temperature rises, followed by vomiting and delirium during the night. In one patient these symptoms lasted for only two days, whilst in others they continued during four days. The same symptoms reappeared four days later, but this time lasted only two days; afterwards yet three attacks were noted, each of which lasted only 4-6 hours, and could be prevented by quinine and also by subcutaneous injection of arsenical compounds. The spleen is enlarged in all the patients."

In the blood from one of these patients spirochaetes closely resembling *S. duttoni* were found, and to this parasite Dschunkowsky has given the name *S. persica.* [Considering that the parasite is morphologically identical with *S. duttoni* and nothing is known beyond its appearance in stained preparations, this naming seems a little premature.]

Some of the ticks supposed to produce this infection were received by the author and fed on sheep. These animals showed rises in temperature that might be attributed to an attack of spirochaetosis, but parasites could never be found in the blood. The ticks are said to be either *Ornithodorus tholozani or O. canestrinii*, and the author gives photographs of both this tick and of *Argas persicus.*

[Although the evidence is incomplete, there seems little doubt that some species of *Ornithodorus* is concerned in the transmission of relapsing fever in Persia, now definitely recorded for the first time. There is some doubt, however, as to the actual species of tick concerned. Nuttall and Warburton* include *O. canestrinii* amongst their list of doubtful species, and Professor Nuttall kindly informs me that, from an examination of the photograph given by Dschunkowsky, he is of the opinion that this tick will be found to belong to the species *Ornithodorus lahorensis*, Neumann.]

E. H.

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* *Ticks: A Monograph of the Ixodoidea.* Part 1. The Argasidae. 1908. Cambridge: University Press.

Coryllos & Pérakis. **Observations de Fièvre Récurrente constatée pendant la Guerre Balkanique, dans les Hôpitaux de la Croix-Rouge Hellénique à Salonique.**—*Bulls. et Mém. de la Soc. Méd. des Hopit. de Paris.* 1913. Mar. 6. 3 ser. Vol. 29. No. 8. pp. 513-518.

The authors describe in detail four cases of relapsing fever (*S. recurrentis*) occurring in Macedonia. In every case the patients were cured by an intravenous injection of 0·25 gm. salvarsan. The disease has not been previously recorded from this locality, but during the war the authors have been able to collect records of 29 other cases in the various military hospitals of Salonica and Vodena.

In addition it is noted that the four patients that came under the authors' notice were all infested with *Pediculus vestimenti*, and that this parasite is very probably responsible for the transmission of the disease.

E. H.

Lamoureux (A.). **Présence d'*Ornithodorus moubata* dans un Foyer de Fièvre Récurrente à la Cote Ouest de Madagascar. (Présentation de Trois Exemplaires.)**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 146-149. With sketch map.

The existence of relapsing fever on the west coast of Madagascar was first recorded by Thézé in 1911, and subsequently three cases were noted by Lamoureux in 1912. The author has observed 22 cases of the fever in individuals that had travelled on foot between Morandava and Majunga; therefore it is evident that in this part of the country relapsing fever is endemic. The spirochaete appears to be identical with *S. duttoni* and further evidence in support of this view is afforded by the discovery of *Ornithodorus moubata* at Mitsijo, a village three days south of Majunga. From the records of the military hospital at Majunga, it appears that in July, 1911, out of 29 men that journeyed through the above mentioned district 25 suffered from an attack of fever clinically resembling the present disease. In addition the author quotes some interesting observations by R. Drury (1702-1720), suggesting that relapsing fever has existed in this region for over 200 years. Drury, in an account of his travels and captivity of Madagascar, writes concerning a village to the north of Morondava:—

"*Fort peu de ceux-ci consentent à séjourner dans les maisons des Vazimbas par crainte d'un insecte semblable à la* Tique des vaches, *qui se rencontre fréquemment sur le bétail et que l'on appelle "Poroponjy"; cet insecte ne se trouve que chez les Vazimbas qui l'élévent à dessein pour que les Sakalaves n'entrent point dans leurs maisons.*

"*Or les gens qui sont mordus par les "Poroponjy" en sont malades pendant six semaines ou deux mois: Ces insectes s'attachent à la peau ou même se glissent dessous; mais une fois qu'on a été mordu et malade, on n'a plus à les redouter et on n'en est plus incommodé par la suite, si nombreux qu'ils soient.*"

E. H.

Transmission.

Nicolle (Charles), Blaizot (L.), & Conseil (E.). **Du Rôle Négatif des Poux dans la Transmission Expérimentale de la Fièvre des Tiques.**—*Bull. Soc. Path. Exot.* 1913. Feb. Vol. 6. No. 2. pp. 106-107.

The authors have attempted to transmit the relapsing fever of Tropical Africa (*S. duttoni*) by means of lice. They employed a virus that had been maintained in mice for such a long time that it had almost lost its virulence for other animals. However, after much difficulty, they infected a very young bonnet monkey, which showed numerous parasites in its blood for three days and then succumbed to the infection.

A number of body-lice were fed on this monkey at the height of the disease, both morning and evening, and subsequently 101 of these lice were fed for 15 days, morning and evening, on a susceptible human being, who remained healthy. In the intervals the lice were kept in a moist chamber at 28° C.

The spirochaetes were observed to disappear from the gut of the louse within two hours after ingestion. Between the eighth and fifteenth days 59 of these lice were dissected and examined with the ultra-microscope, but spirochaetes never reappeared in them as in the case of the North African virus (see this *Bulletin*, No. 1, p. 32). The authors conclude, therefore, that lice are unable to transmit *S. duttoni*, but the results are not very conclusive for, as noted in their article, they employed a very attenuated virus in their experiment.

E. H.

Treatment.

Rothermundt (M.), Dale (J.), & Peschić (S.). **Das Quecksilber in der Therapie der Spirochäteninfektion auf Grund experimenteller Studien an Tieren.** [Mercury in the Treatment of Spirochaetal Diseases on the Basis of Experimental Studies on Animals.]—*Zeitschr. f. Immunitatsforschung u. experiment Therapie.* 1. Teil., Orig. 1913. Jan. 18. Vol. 16. No. 2. pp. 224-248.

The present paper contains the results of a number of experiments on the therapeutic action of various mercury compounds on spirochaetal infections. In all cases fowls infected with a very virulent strain of spirochaetosis were employed for the experiments. The paper is merely an extension of those previously published by Kolle, Rothermundt and Peschić (see this *Bulletin*, No. 1, p. 38) and Kolle, Rothermundt and Dale.

The authors' summary is as follows:—

(1) It is possible to cure fowl spirochaetosis with any mercury preparation if administered in sufficient quantity.

(2) There is no marked difference in therapeutic properties between soluble and insoluble preparations.

(3) The dosis curativa of inorganic and organic mercury compounds belonging to the aliphatic series depends directly on the percentage of mercury in the compound.

(4) On the contrary the action of organic mercury compounds belonging to the aromatic series, *e.g.* Hermophenyl, Asurol, &c., does not depend on the amount of mercury but on the constitution of the compound.

(5) The mercury salt of dimethylphenylpyrazolonsulphamine is found to be the most effective organic mercury compound in the treatment of fowl spirochaetosis.

(6) In this compound the sulphamino group greatly reduces the organotropism without affecting the parasitotropism, the result being a substance in which the relation $\frac{\text{Dosis curativa}}{\text{Dosis toxica}}$ is only $\frac{1}{100}$.

E. H.

Uhlenhuth (P.), Mulzer (P.), & Hügel (G.). **Die Chemotherapeutische Wirkung on organischen Antimonpräparaten bei Spirochäten-und Trypanosomenkrankheiten.** [The Therapeutic Action of Organic Antimony Compounds on Spirochaetosis and Trypanosomiasis.]—*Deut. Med. Wochenschr.* 1913. Feb. 27. Vol. 39. No. 9. pp. 393-395.

The authors have tested the effects of various organic mercury compounds on spirochaetal and trypanosome infections, but especially on fowl spirochaetosis. The sodium salt of p-aminophenyl-antimonate and also its acetyl derivative were found to have a marked curative action on the disease, the relation of the Dosis curativa and Dosis letalis being about 1 : 2.

A large number of other compounds were also tried, but only two of them gave satisfactory results. These two compounds, the sodium salts of benzol-sulpho-*p*-amino-phenyl-antimonate and *p*-urethanophenyl-antimonate, both possess marked preventive and curative action on fowl spirochaetosis. Both preparations are easily soluble in water, the first producing an alkaline and the second a neutral solution. The percentage of antimony in the two is respectively 26 per cent. and 32 per cent.

The action of these two compounds on fowls infected with spirochaetosis is shown in a number of tables and their curative action is well marked.

In the case of the sodium salt of benzol-sulpho-*p*-aminophenyl-antimonate the toxic dose is about 0·2 gm. and the curative dose from 0·05 to 0·02 gm. per kilo. The sodium salt of *p*-urethanophenyl-antimonate is even more effective, for the toxic dose is not more than 0·2 gm. whilst the curative dose is 0·02 gm. per kilo, giving a therapeutic coefficient of 1 : 10.

In conclusion the authors state that they have obtained good results in the treatment of syphilis in rabbits, and relapsing fever, dourine and sleeping sickness in rats, by means of the latter two preparations and also the sodium salt of acetyl-*p*-aminophenyl-antimonate. The action of the latter compound on rabbit syphilis is very marked and will be the subject of a future paper. A human patient suffering from syphilis received a subcutaneous injection of this substance. "The injection was both irritating and painful, but the therapeutic action could not be ignored."

E. H.

Paucot (M.). **Action de l'Atoxyl et du Salvarsan sur la Fièvre Récurrente.**—*Bull. Soc. Path. Exot.* 1913. Jan. Vol. 6. No. 1. pp. 68-80.

During the year 1912 an epidemic of relapsing fever occurred in Nam-Dinh (Indo-China), and the author was able to compare the therapeutic action of salvarsan with that of atoxyl on the course of this disease.

The patients treated with atoxyl received subcutaneous injections of 0·5 gm. *pro die* until the spirochaetes disappeared, and any relapses were treated in the same manner. In all thirteen cases were treated with atoxyl, of which six showed relapses. The parasites disappeared only two to five days after the commencement of the treatment, and the convalescence of the patients was prolonged, with marked anaemia and asthenia. It is evident, therefore, that treatment by means of atoxyl must be abandoned in the case of relapsing fever.

One hundred and two patients were treated by subcutaneous injections of 0·2 gm. of salvarsan and only six died. The author remarks that without treatment and proper care the mortality would have been from 50 to 75 per cent. In addition 87 patients were treated by intravenous injections of salvarsan, and the author gives the subsequent clinical history of each case. Six were injected with 0·1 gm. of salvarsan and four of them relapsed, one a second time; eleven patients received injections of 0·15 gm. and four relapsed, two of them a second time; twenty patients were injected with 0·2 gm. and eight relapsed, one a second time; 27 patients were injected with 0·25 gm. and thirteen relapsed, two of them a second time; finally, 23 patients were injected with 0·3 gm. and thirteen relapsed, four a second time. Out of this total of 42 relapses, spirochaetes were only present in the blood of twenty of the cases. Injections of salvarsan considerably delay the appearance of relapses, some of the first relapses not appearing until the 20th to 27th day after the end of the first attack. Usually, in the relapses, spirochaetes are not present unless the dose of salvarsan has been insufficient.

Only two of these patients died and in both cases death was the result of dysentery and not directly due to the fever.

The author advises the employment of intravenous injections of 0·2 to 0·25 gm. of salvarsan in all cases of relapsing fever. This dose ought not to be exceeded, as the results obtained with 0·3 gm. were inferior to those obtained with the smaller dosage, it being understood that this dose refers to Annamites of an average weight of 40 to 45 kilos.

Any relapses should be at once treated by a second intravenous injection of 0·15 gm., which is usually followed by the recovery of the patient within a few hours.

[Although under certain conditions the relapsing fever of Indo-China may present a rather high mortality, the author's estimate of 50 to 75 per cent. seems somewhat excessive. The favourable results obtained by the use of injections of salvarsan are confirmatory of those previously described from the same country (see this *Bulletin*, No. 1, pp. 34-35).]

E. H.

GERBER. **Die bisherigen Erfahrungen mit der Salvarsan- und Neosalvarsanbehandlung der lokalen Spirochätosen.** [The Present Knowledge of the Treatment of Local Spirochaetosis by Salvarsan and Neosalvarsan.] — *München. Med. Wochenschr.* 1913. Mar. 25. Vol. 60. No. 12. pp. 634-636.

The author divides spirochaetal infections into two groups, *viz.*, general and local spirochaetosis, respectively. Under the former heading are included syphilis, yaws and the various relapsing fevers, and under the latter Vincent's angina, gingivitis simplex, noma, &c. The present article contains a useful summary of our knowledge of the action of salvarsan and neosalvarsan on the latter group of diseases, from which it is evident that these medicaments are as effective in local as in general spirochaetal infections.

E. H.

CULTIVATION.

DANULESCO (V.). **Essais de Culture du Spirille de la Poule.**—*Compt. Rend. Soc. Biol.* 1913. Feb. 28. Vol. 74. No. 8. pp. 369-371.

The author has succeeded in cultivating the fowl spirochaete by NOGUCHI's method (*see* this *Bulletin*, No. 7, p. 384) and gives an account of the technique. The blood of a heavily infected fowl is mixed with an equal quantity of sterile sodium citrate solution (1·5 per cent. dissolved in 0·9 per cent. NaCl). Into a tube is put a small piece of rabbit kidney and afterwards ten drops of the citrated blood containing the spirochaetes; then 10 to 15 cc. of sterile, non-filtered, ascitic fluid is added and finally half the tubes receive, in addition, a layer of vaseline. The tubes are then kept at 37° C.

The ascitic fluid was obtained from four cases of cirrhosis of the liver, and the fluid of one of these patients was found to give much better results than that of the other three.

The spirochaetes were found to remain alive at 37° C. from 24 to 36 hours in citrated blood, 48 hours in broth containing a piece of fresh tissue, a little longer in ascitic fluid, and finally 15 to 20 days in the above described medium covered with vaseline.

Subcultures were obtained from cultures that were four to seven days old, and in this manner the author has succeeded in obtaining five passages, after which the spirochaetes seemed to be unable to multiply.

In conclusion Danulesco remarks that the cultures never contain many spirochaetes, are very difficult to obtain, and still more difficult to continue. The method is therefore of little practical use, although undoubtedly of value. Perhaps by a slight modification in the technique it might be possible to obtain better results.

E. H.

UNCLASSED.

DOHI (K.) & HIDAKA (S.). **Sind die Spirochaeten den Protozoen oder den Bakterien verwandt? (Experimentelle Untersuchungen über die Stellung der Spirochaeten im System.)** [Are Spirochaetes related to the Protozoa or the Bacteria? (An Experimental Investigation of the Systematic Position of the Spirochaetes).]—*Arch. f. Dermatol. u. Syphilis.* Orig. 1912. Dec. Vol. 114. No. 2. pp. 493-502.

The authors have investigated the serum reactions in infections of *S. duttoni*, comparing them with those of *Trypanosoma brucei*, *Spirillum rubrum* and *Vibrio* (Nordhafen) respectively.

The fixation of the complement was tested between spirochaete immune serum and various antigens, but positive results were only obtained with the liver extract of a rabbit infected with the spirochaete. With regard to agglutination and lysis phenomena, they found that immune rabbit serum, one month after infection with *S. duttoni*, in dilutions of 1 in 10 immobilised and agglutinated the spirochaete. In a similar dilution the same serum immobilised, but did not agglutinate *T. brucei*, and was without effect on *Spirillum rubrum* and *Vibrio*.

Similar experiments were performed employing in turn the immune sera of *T. brucei*, *Sp. rubrum* and *Vibrio*, respectively. In every case, the results are said to support the view that the spirochaetes are related to the Protozoa and not to the Bacteria.

E. H.

ASHBURN (P. M.), VEDDER (E. B.) & GENTRY (E. R.). **A Spirillum in the Blood of a Case of Blackwater Fever.**—*Bull. Manila Med. Soc.* 1912. Dec. Vol. 4. No. 12. p. 198.

The authors observed spirochaetes in the blood of an East Indian in the Philippine Islands suffering from blackwater fever. The morphology of the parasite is practically identical with that of the organisms found in the relapsing fever of India. Relapsing fever has not previously been reported from this locality.

E. H.

HOLMES (J. D. E.). **A Note on Elements resembling Spirochaetes Found in Blood Preparations from Man and Animals.**—*Indian Civil Vet. Dept. Memoirs.* 1912. No. 3. pp. 272-276. With one plate.

The author describes the appearance of various alterations in the blood cells that, in their external form, are very suggestive of spirochaetes. Figures are given of forms observed in the blood of patients suffering from malaria, and also similar bodies occurring in the blood of guinea-pigs that had been inoculated with blood from a malarial patient. Although the forms observed are devoid of structure and are irregular in size and shape, some of them seem to be identical with the forms described by LINGARD as endoglobular stages of spirochaetes. The author also mentions the elements described by the brothers SERGENT* under the title

* *Annales de l'Institut Pasteur*, 1905. Mar. Vol. 19. p. 138.

of "*Corps en anneau*" and "*Corps en demilune*" respectively, and in addition Brumpt has recorded the presence of similar elements in the blood from malarial patients. It appears, therefore, without doubt that all these appearances are of similar origin and are produced by modifications in the red blood corpuscles under the influence of certain diseases and also by haemolytic agents.

[The extraordinary forms assumed by degenerating corpuscles have been well described by Nuttall and Graham-Smith* under the name of haemaconia, and those figured by the author are identical in every respect with those occurring in the blood of dogs suffering from piroplasmosis.]

E. H.

von Prowazek (S.). **Untersuchungen über die Tona der Pferde auf Samoa.** [Researches on the "Tona" of Horses in Samoa.] —*Arch. f. Schiffs. u. Trop.-Hyg.* 1913. Jan. Vol. 17. No. 1. pp. 1-8. With 4 text-figures.

In Samoa the native name "Tona" (signifying yaws) is also applied to two infections of horses that are characterised one by the development of sores in the neighbourhood of the eyes, and the other by the growth of large tumours on the fetlocks. Prowazek shows that the former of these is merely the result of bacterial contamination, whereas the latter, known as "Foot-tona," is caused by separate infection.

The author gives a description of the pathological lesions and etiology of this disease, which is found to be associated with the presence of a spirochaete. This organism, however, only plays a secondary rôle in the development of the tumour and is found, together with fusiform bacilli and other bacteria, in the deeper layers. Attempts to transmit the infection to other horses gave only negative results. A consideration of the histology of the tumour shows that it is probably a carcinomatous condition that secondarily becomes infected with various micro-organisms.

The author also discusses the nomenclature of the spirochaetes, which at present is in a very confused state. Since the use of the name *Spirochaeta* is now restricted to certain free living forms (*S. plicatilis*), it is necessary to decide which generic name should be employed for the pathogenic spirochaetes other than *Treponema*. Amongst the large number of names that have been proposed, Prowazek finds that *Borrelia* (Swellengrebel, July 1907) has priority, for the term *Treponema* is not applicable until *T. pallida* has been proved to belong to the same genus as the other pathogenic spirochaetes. Figures are given of the *Borrelia* occurring in the Foot-Tona of horses. The author distinguishes three types of parasites named *Borrelia tonae magna, media* and *minima*, respectively. These were found to multiply by transverse division, but appearances suggesting longitudinal division were also encountered.

E. H.

* *Journal of Hygiene.* 1907. Vol. 7. p. 268.

KALA AZAR.

Nicolle (Charles). **Origine et Rapports du Kala Azar et du Bouton d'Orient. Rapport présenté le 27 Septembre 1912 à la 8e Section du XVe Congrès d'Hygiène et de Démographie de Washington.**—*Arch. de l'Inst. Pasteur Tunis.* 1912. No. 4. pp. 219-224.

This paper contains a brief resumé of the state of our knowledge of the various leishmaniases. Only one or two points will be noted. The author, who created the name *Leishmania infantum* for the parasite of the Mediterranean infantile kala azar to distinguish it from the Indian parasite *Leishmania donovani,* points out that nearly all the supposed differences between the Indian and Mediterranean diseases have been disproved. There still remains the fact that so far no one has yet succeeded in reproducing the Indian disease in dogs while the Mediterranean disease can be thus reproduced fairly readily. At present then the author is inclined to retain the name *Leishmania infantum* for the Mediterranean parasite. As regards the disease known as oriental sore and by a host of other names the author believes that all over the Old World there is but one cutaneous leishmaniasis always due to the same parasite (*Leishmania tropica*). It still remains to be proved whether the cutaneous leishmaniasis of South America is due to the same or another parasite. It is pointed out that the claim of Basile that he has transmitted kala azar from dog to dog by means of fleas and the later and similar experiments by the brothers Sergent and others (see this *Bulletin,* No. 7, p. 368) fit in well with what is known of the distribution of the Mediterranean form of the disease in dog and man. He points out that Patton's claim that the bed bug transmits Indian kala azar, based on the development undergone by the leishmania in this insect, is without foundation and that only positive transmission experiments can determine the carrier. The problem of the transmission of oriental sore still remains unsolved, but the author hopes to find the reservoir (animal or plant) of the virus, if such exists, as he has already done in the case of kala azar.

C. M. Wenyon.

Gabbi (U.). **Intorno all' Origine Canina della Leishmaniosi Interna (Kala-azar).** [The Canine Origin of Kala Azar.]—*Malaria e Malat. d. Paesi Caldi.* 1913. Jan. Vol. 4. No. 1. pp. 7-19.

This long paper contains no original matter but is a review of previous work, made with the object of showing that Nicolle's idea of the identity of canine and infantile kala azar in the Mediterranean district is untenable. It is pointed out that in those districts where the canine and human diseases exist there is no parallelism between the numbers of each. The transmission experiments of various observers are criticised on the ground that adequate precautions had not been taken to exclude the possibility of a previous infection of the animals employed. The well-known argument that the flagellates in the fleas used in these experiments may be other than leishmania is again brought forward. Most of the points in this paper have been already emphasized by

the author and others in earlier papers, and are generally quite evident to anyone conversant with the details.

[In spite of a want of parallelism in the numbers of cases and in the seasonal incidence of canine and infantile kala azar (even if the data available are reliable enough to warrant such a statement), it still remains a fact that the two diseases occur side by side all along the Mediterranean coast; the human disease is inoculable into dogs and produces symptoms indistinguishable from those of the natural canine disease, so that it appears to the writer of this review that it is more reasonable to assume that the two diseases are identical than that they are distinct.]

C. M. W.

Laveran (A.). **Au Sujet de l'Historique du Kala-azar Méditerranéen.**—*Bull. Soc. Path. Exot.* 1913. Jan. Vol. 6. No. 1. pp. 23-24.

Gabbi (U.). *Ibid.* Mar. No. 3. pp. 141-143.

Laveran recalls the fact that the first case of Mediterranean kala azar noted was one seen by Dr. Cathoire in March 1904 at La Goulette (Tunis). The patient, a child of seven months, was seen only at the last stage of its illness. It was found post mortem to have a large spleen, and Dr. Cathoire forwarded smears of this organ to Professor Laveran because of certain structures he had encountered in the stained films. Laveran gave a description of the organism before the meeting of the Academy of Medicine on March 22nd, 1904. His description was an accurate one, and he called attention to the marked resemblance between these bodies and those discovered the year before by Leishman and Donovan in cases of Indian kala azar. He emphasized the necessity for a close enquiry into this new disease which Dr. Cathoire had shown to exist in Tunis. It was in the following year (1905) that Pianese described the first case of the disease from Italy, though his description of the parasite was less accurate than that of the author given the year before. The author's object in calling attention to these facts is to show that Mediterranean kala azar was first recognised by Cathoire and himself and not by Pianese who is frequently credited with having made the discovery first.

Gabbi claims that the disease was recognised clinically by Cardarelli in Naples in 1880, but Laveran considers that the symptoms of the disease are not sufficiently characteristic to enable one to be sure of this, so that the discovery of the disease must date from the discovery of the parasite.

C. M. W.

Transmission.

Scordo (F.). **Sulla Questione della Trasmissibilità del Kala-azar per mezzo di alcuni Insetti Ematofagi.** [The Transmission of Kala Azar by Blood-Sucking Insects.]—*Malaria et Malat. d. Paesi Caldi.* 1913. Jan. Vol. 4. No. 1. pp. 20-32. With 1 plate.

The greater part of this paper is occupied with a discussion of the work previously done by various observers on the transmission of kala azar by means of biting insects.

An account of some experiments conducted with mosquitoes (both anophelines and Culex) and cultures of *Leishmania infantum* is then given. Some difficulty was experienced in inducing the mosquitoes to take up the culture. In order to prevent their becoming involved in the liquid, the author took up the culture fluid by soaking in it small pieces of flesh. These were then enclosed in a piece of gauze which was suspended under a glass. It was easy to observe the mosquitoes feeding through the gauze, and one could be certain that they had taken up the culture as their abdomens became distended with the red fluid. Directly after feeding it was found that the fluid in the stomach of the mosquitoes contained all the cultural forms. Soon after these commenced to degenerate, so that after the lapse of six hours it was difficult to find any forms not in advanced stages of degeneration. After twelve hours no leishmania could be found. These experiments do not agree with the similar ones conducted by Franchini, who found that the cultural forms taken up by mosquitoes survived for 48 hours and that the flagellate forms became transformed into small round forms. The author doubts very much whether the bodies seen by Franchini were in reality developed from the cultural forms taken up. Similar experiments have been made by Basile and Franchini with bugs and fleas, but these observers never observed any flagellates in these insects, so there is no proof that the fleas or bugs had ever taken up any culture. In the author's opinion there is no evidence that the cultural forms of leishmania will live and develop in mosquitoes, and he regards this as an argument against the mosquito transmission theory of kala azar. The paper concludes with a general discussion on the insect most likely to be the transmitter of the disease.

C. M. W.

Clinical.

Lignos (Antoine). **Un Cas de Fièvre Réellement Noire (Kala-azar) observé à Hydra.**—*Bull. Soc. Path. Exot.* 1913. Feb. Vol. 6. No. 2. pp. 114-117.

The author records a case of kala azar in a child of one year from the Isle of Hydra. The illness, which was of under four months' duration, followed the usual course with irregular fever, large spleen and liver reaching the left and right iliac crests respectively, anaemia and other usual symptoms. The peculiar feature of the case, however, was one which has been noted in this disease by the physicians of Hydra long before it was recognised as a leishmaniasis. A week before the child's death the author noted that the face showed some black patches. During the succeeding days the general black tint of the face increased in intensity and the same condition, though less marked, was seen on the skin of the body. The author describes the child's appearance as being that of a candle which has become smoked as a result of burning in a wind or of one's fingers which have become blackened through attempting to produce a fine point on a lead pencil. At the autopsy leishmania were discovered in the organs.

C. M. W.

Mazzitelli (Pietro). **Intorno a un Caso di Anemia Infantile da Leishmania proveniente da Monte S. Biagio in Provincia di Caserta.** [A Case of Infantile Kala Azar from Monte S. Biagio.]—*Policlinico.* Sez. Medica. 1913. Feb. Vol. 20. No. 2. pp. 78-88.

This paper commences with a long summary of the present state of our knowledge of kala azar. The author then describes in great detail a typical case of the disease in a child six years old from Monte S. Biagio in the province of Caserta near Rome. This is the fourth case encountered in this district, Gabbi (1910), Basile (1911) and Concetti (1911) each having recorded single cases from Rome.

C. M. W.

Spagnolio (G.). **Leishmaniosi Interna (Kala-azar) a Messina. Nuovi Esempi Clinici e Sguardo Riassuntivo.**—*Riforma Medica.* 1913. Feb. 22. Vol. 29. No. 8. pp. 199-201.

This paper is substantially the same as an earlier one by the same author, for a notice of which see this *Bulletin.* No. 7. p. 361.

C. M. W.

Migone (L. E.). **Un Cas de Kala-azar à Asuncion (Paraguay).**—*Bull. Soc. Path. Exot.* 1913. Feb. Vol. 6. No. 2. pp. 118-120.

The case described is that of an Italian who went to South America in 1897. He lived in Santos (Brazil) till 1910 when he removed to Sao Paulo to obtain work in connection with the railway. In February 1911 he became ill with rigors, fever, diarrhoea and lassitude. He had had a similar and first attack some time before. He was treated with quinine without definite result. Not being satisfied with his progress he went to Asuncion in the Middle of May. On arrival his condition was as follows.—He was much wasted, weak, very anaemic with spots on his face, back, chest and the back of his hands; the abdomen was prominent and his respiration laboured; the tongue was coated; fever (38-39·5° C.) preceded by rigor occurred every afternoon; there was epistaxis and dysentery; the spleen and liver were both enlarged, smooth, and slightly tender. As the patient did not react to quinine a very careful examination of the blood was made, with the result that a leishmania was discovered. The diagnosis was confirmed by a further examination of material drawn directly from the liver and spleen. The case was undoubtedly one of kala azar and not malaria as had been supposed. The blood picture was as follows: Red corpuscles 3,900,000, white corpuscles 3,400 (polynuclears 49 per cent., lymphocytes 10 per cent., mononuclears 36 per cent., eosinophiles 1 per cent.).

The patient received an intramuscular injection of 0·60 gram of '606.' Following this there was some temporary improvement in his condition, but a month later after a severe attack of diarrhoea

he died. The parasites had persisted in the blood and also in the spleen. No satisfactory autopsy was performed.

At the time that the author encountered this case he was engaged in studying the disease known as Bouba, due to a leishmania. This parasite however appears smaller than that encountered in kala azar, and further in Bouba the parasite occurs neither in the peripheral blood nor in the internal organs.

[This is the first case of kala azar recorded from South America.]

C. M. W.

Experimental.

Laveran (A.). **Infections du Cobaye, du Lapin et du Chat par la *Leishmania infantum*.—*Bull. Soc. Path. Exot.* 1913. Feb. Vol. 6. No. 2. pp. 110-114.**

The author passes in review the various attempts, successful and otherwise, which have been made to infect guinea-pigs, rabbits, and cats with *Leishmania infantum*.

Guinea-pig. In 1909 the author in conjunction with Pettit showed that the leishmania obtained from the organs of infected animals would survive in the peritoneal cavity of guinea-pigs for at least 59 days and were still culturable in NNN medium. Franchini (1911) obtained a general infection of a guinea-pig by the injection intraperitoneally of 1 cc. of a fifteen days old culture which was in its eighth passage. This is the sole success against many failures after inoculation of both virus and culture by Nicolle and Blaizot, the author and others, though the intraperitoneal, intravenous, and intrahepatic methods of inoculation were all attempted.

Rabbit. Volpino produced a local lesion on the cornea of a rabbit by scarification and application of a piece of bone marrow from an infected dog. Three months later there was a keratitis which yielded large mononuclear cells containing leishmania. Mantovani produced a general infection by the intravenous injection of 1 cc. of culture. Twenty days later the animal was killed and leishmania were found in its organs which yielded a culture of flagellates when inoculated on to NNN medium. Many unsuccessful attempts have been made by the author and others to infect these animals both from virus and culture.

Cats. In spite of many attempts with these animals no one has yet succeeded in infecting them with *Leishmania infantum*. Though many cats have been examined in those districts in which dogs are known to be naturally infected, the only instance in which the examination yielded a positive result was in the case of a young kitten examined by the brothers Sergent, Lombard, and Quilichini in Algiers. In this instance the cat was associated with a dog and child both infected in the same house.

It thus appears that attempts to infect these animals with *Leishmania infantum* yield in most cases negative results. The conditions which have given positive results in a small number of cases have not been determined.

C. M. W.

Bandi (Ivo). **Preliminary Note on the Identity of Certain Leishmaniases based on Biological Reactions.**—*Jl. Trop. Med. & Hyg.* 1913. Feb. 15. Vol. 16. No. 4. p. 50.

The author has observed that the repeated intravenous injection of rabbits with cultures of leishmania of human or canine origin gives rise to no disease, but on the other hand causes the appearance in the blood of substances capable of agglutinating the cultural forms. The serum of rabbits injected with cultures of canine leishmania agglutinated cultures both of canine leishmania and *Leishmania infantum* in dilutions of 1 in 160. The sera of these rabbits further produced agglutination of cultures of *L. tropica* in a dilution of 1 in 70. There appears to be a leishmanial group agglutination. These experiments tend to support Nicolle's view as to the identity of the parasites causing the infantile and canine kala azar.

C. M. W.

Canine Kala Azar.

Lignos (Antoine). **L'Infection par Leishmania des Chiens de l'Ile d'Hydra.**—*Bull. Soc. Path. Exot.* 1913. Feb. Vol. 6. No. 2. p. 117.

The population of Hydra is not over 6,000 and the annual birth rate has a maximum of 120; yet at least ten children become infected with kala azar each year, a fact which shows that the disease is more common in this island than in other countries in which kala azar occurs.

During the summer of last year the author examined 48 dogs, being half the total number of these animals in the island. He would have continued the observations further but for the inhabitants of the island, who objected to having their dogs killed. The following results were obtained:—

May	...	...	5	dogs examined,		1	infected.
June	...	...	16	,,	,,	2	,,
July	...	...	8	,,	,,	1	,,
August	...	...	10	,,	,,	1	,,
September		...	7	,,	,,	2	,,
October	...	...	2	,,	,,	1	,,

This result gives a percentage of 16·66 dogs infected.

C. M. W.

Gray (A. C. H.). **Leishmaniose Naturelle du Chien à Tunis.**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 165-166.

This paper refers to the examination of dogs in Tunis for evidence of leishmania infection. Nicolle and Compte, during March, April and May 1908, found four dogs infected out of 222 examined. W. and N. Yakimoff examined 299 dogs from January to May 1911 and found five infected. Apart from these examinations Nicolle discovered a dog with the disease at Khéreddine near Goulette (a suburb of Tunis) in July 1911, and in September of the same year Langeron found another.

The writer of the present paper has made a further examination of Tunisian dogs between October 16 and December 5, 1912, with the result that he discovered two cases of infection out of 127 dogs examined. From the three series of examinations it appears that the percentage of Tunisian dogs suffering from kala azar varies from 1·8-1·6.

C. M. W.

Tropical Sore.

Pulvirenti (G.). **La Leishmaniosi Cutanea nelle Provincie di Catania e Caltanissetta.** [Dermal Leishmaniasis in the Provinces of Catania and Caltanissetta.]—*Malaria e Malat. d. Paesi Caldi.* 1913. Jan. Vol. 4. No. 1. pp. 32-43. With 7 text-figures.

The first cases of dermal leishmaniasis or oriental sore to be described in Italy were those of Gabbi and La Cava (1910) from Calabria and Sicily. Other cases were described later by Timpano (Bova Marina), by Sergi (Palizza Marina), by Costa (Riace Camini), by Jemma (Palermo) and by Genoese (Cantonia). During the years 1911 and 1912 the author has encountered six cases of this disease, one from the province of Caltanissetta and five from the province of Catania. In each of these there was a single lesion on some part of the face, ear or lips. The ages of the victims varied from 3 to 55 years. In one case the sore on the lips was situated at the right angle of the mouth and had extended to the lining mucosa of the cheek. The author compares this case with the South American leishmaniasis in which, however, a much more extensive involvement of the mucosae occurs. In other respects the six cases described offer no peculiar features.

A lengthy discussion on the relation of oriental sore to kala azar is added. Some experimental work with a view to determining this relation was undertaken. A monkey (*Macacus sinicus*) was inoculated intrahepatically with material obtained from the sore of one of the cases. The monkey developed no symptoms, but a liver puncture was performed about forty days after the inoculation. In smears stained by Giemsa leishmania were found. A month later the monkey being in good condition was killed. Examination of the organs microscopically and by culture gave a negative result. The author makes no comment on the result of this experiment.

C. M. W.

Cipolla (Michelangelo). **Ein Fall von Orientbeule in der Provinz Palermo.** [A Case of Oriental Sore in the Province of Palermo.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Jan. 23. Vol. 67. No. 7. pp. 521-523. With 2 figs.

This paper describes a case of tropical sore in a girl of fifteen years of age from the Province of Palermo. There was a single sore about one centimetre in diameter on the cheek beneath the right eye. Leishmania were discovered in material taken from the sore. The case was a typical one.

C. M. W.

Castellani (Aldo). **Indian Oro-Pharyngeal Leishmaniasis.**—*Jl. Trop. Med. & Hyg.* 1913. Feb. 15. Vol. 16. No. 4. pp. 49-50. With 2 figs.

The case described is that of a European aged 38 who had been in India for 20 years. He consulted the author for an ulcerative condition of the throat which had commenced nine years before. A local examination showed the presence of several ulcers on the posterior wall of the pharynx and on the soft palate; they were roundish and mostly from about a quarter to half a centimeter in diameter. There was no tendency to the formation of vegetations nor any framboesiform appearance. The lymphatic glands of the neck were not enlarged and the condition produced a certain amount of discomfort but little pain. A physical examination showed the spleen to be just palpable on deep inspiration. Scrapings from the ulcers showed typical leishmania in small numbers. The author saw a similar case some time before but a diagnosis of leishmania was not made. There were no cutaneous lesions of any kind in these cases; both patients had suffered from fever from time to time but they had regarded this as malaria.

The author was not in a position to follow up either of these cases, so was not able to determine whether they were cases of kala azar with local lesions in the throat, or merely oriental sore in this position, or a disease like the oral leishmaniasis of South America. The duration is against the kala azar view and the character of the lesions is not that described for the South American disease. The author says therefore that the possibility cannot be excluded of there being an Indian or Asiastic type of oro-pharyngeal leishmaniasis.

C. M. W.

Migone (L. E.). **La Buba du Paraguay, Leishmaniose Américaine.**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 210-218.

This paper gives an account of the disease known as "Buba" in Northern Paraguay. It is the form of leishmaniasis which occurs in other parts of South America and has been described by Escomel, Carini, Splendore (see *Kala Azar Bulletin,* No. 2, p. 103, etc. and this *Bulletin,* No. 1, pp. 11-14). The disease commences as a papilloma on some exposed part of the body as in oriental sore. Ulceration of this may follow, and eventually after eight or nine months lesions appear in the nose and mouth in the form of either ulcers or papillomatous growths. However severe these nasal and buccal lesions the tongue and bones of the face never appear to be involved in the destructive process. The primary cutaneous lesions may be single, but frequently several papules appear at once. After four or five months as many as forty cutaneous lesions may be present, varying in size from that of a 1 to that of a 5 franc piece or even covering the entire dorsum of the foot or encircling the limb. A feature of the disease already noted by other observers is the involvement of the lymphatic system. There is a lymphangitis with the formation of hard red subcutaneous cords and nodosities; the lymphatic

glands draining the region of the ulcer are at first large and painful, but later, though they remain enlarged, the pain disappears. The ulcers may show a tendency to develop granulations in the form of framboesia-like tumours or they may remain crusted over and level with the skin. After involvement of the nasal and buccal cavities the whole lining mucosa including that of the larynx ultimately becomes affected, so that breathing and deglutition become difficult. The nasal septum is destroyed and the margins of the nostrils and lips become gradually eroded. The condition can readily be confused with lupus, syphilis, sporotrichosis, cancer, etc. The victim suffers from a peculiar bronchitis, with fever, pains, and anorexia and finally dies of tuberculosis or some other intercurrent malady.

The disease shows no predilection for any age or sex or any nationality. The infection takes place in the forest districts and is so prevalent in some localities that of 100 labourers who enter the forest regions after two or three months 70 or so will return infected, some with one or two ulcers, others with ten or twelve, and some with thirty or forty distributed over various parts of the body. The disease has apparently spread from Brazil, and owing to lamentable negligence the ulcer has developed to such an extent in the district that hardly a house exists in which several people are not infected. The author points out that the disease appears to have been described by Sauvage and Charluis as long ago as the year 1759.

The victims are unanimous in attributing the disease to the bite of some noxious arthropod. The one most commonly accused is a tick of the genus Amblyomma. [Flu is inclined to regard a tick as the cause of "Bosch yaws" or "Forest yaws," also a leishmaniasis, see *Kala Azar Bulletin*, No. 2, p. 109.] The author however believes he has seen the initial lesions commence at the wounds inflicted by other insects such as mosquitoes and horse flies or even thorns of plants.

It is always possible to discover leishmania in the lesions both cutaneous and mucosal, though it may be difficult in the more chronic ones. The author has not succeeded in inoculating the disease in animals nor in obtaining a culture of the organism on blood agar (see this *Bulletin*, No. 1, pp. 12 and 13).

As regards treatment the early lesions are easily got rid of by the use of caustics or the thermocautery, together with iodide of potassium and arsenic by the mouth. When the cutaneous lesions are more advanced a cure is difficult to effect, though cauterisation together with '606' repeated three or four times has given good results. In the final stage when the mucosae are involved the disease is very intractable, but hectine with '606,' orsudan, or soamin has favourably modified the condition. Healing is however exceedingly slow and local application of caustic is always necessary. In these cases even after three or four injections of 60 centigrams of '606' or three months' treatment with soamin it has still been possible to detect the parasites in the lesions.

The paper is illustrated with four photographs showing the serious conditions which may result from this disease.

C. M. W.

Franchini (G.) & Mantovani (M.). **Il Primo Caso di Leishmaniosi Cutanea Brasiliana in Italia Diagnosticato col Reperto del Parassita.**—*Pathologica.* 1913. Mar. 15. Vol. 5. No. 105. pp. 163-171.

Franchini (G.). **Sur un Cas de Leishmaniose Américaine. Le Premier Cas en Italie avec la Constatation du Parasite.** *Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 219-226.

The case here described is that of an Italian who had resided in Brazil for several years. He returned to Italy and was seen by the author on account of a peculiar and intractable ulceration which had commenced three years before at the gluteal fold at the upper part of the left thigh. The ulceration, which was at first slight, had extended in spite of vigorous treatment both surgical and medicinal till the condition described was reached. There was a large lesion about seven centimetres in length consisting of ulcerated and inflamed foci partly covered with scabs and partly discharging a purulent fluid. Surrounding this were others smaller but of the same nature. On the right gluteal region were several similar but smaller lesions. The patient appeared healthy and no other abnormal feature was found. The Wassermann reaction was always negative.

The diagnosis was made by the finding of leishmania in scrapings from the sore and also by the obtaining of a culture of the organism on NNN medium by abstracting blood from the margin of the lesion. The parasite is described as showing large forms 5μ-6μ in diameter, medium sized forms 2μ-3·5μ and finally small oval forms 1·5μ-2μ in diameter. The author has noted that some of the parasites show the peculiar flattening of the trophonucleus against the margin as first described by Laveran and Nattan-Larrier (this *Bulletin.* No. 1. pp. 12 and 13). Parasites were never found in blood taken at a distance from the lesion nor were any flagellate forms seen. In culture the flagellates present the characters usually seen in cultural forms of leishmania. The author mentions them as having a length of 10-15μ and a breadth of 1·5-2·5μ; the flagellum is sometimes 40μ in length. [Culture of the leishmania from S. America skin lesions has been previously described—Pedrosa & Dias da Silva (*Kala Azar Bulletin.* No. 2. p. 103), Piraja da Silva (this *Bulletin.* No. 1. p. 14) and Wenyon (*Ibid.*, p. 15).]

With scrapings from the lesions animals were inoculated as follows:—Three guinea-pigs with the result that suppurating foci developed. In scrapings from these very rare leishmania were found; they had disappeared in nine days. A similar condition developed in one of a series of rats inoculated after nine days. In this lesion also very rare but distinct leishmania were found. An even less definite result was obtained in the case of a dog. [Successful inoculation of this disease is described by Splendore and by Wenyon (this *Bulletin.* No. 1. pp. 11-14).] The inoculation of cultures has given only negative results.

The case was treated by excision of the lesions with subsequent grafting of skin. A complete cure resulted. The histological

findings are described in detail. It is interesting to record the presence of undoubted giant cells [previously noted by Nattan-Larrier, Touin and Heckenroth, *Kala Azar Bulletin*. No. 2. p. 107].

The author believes, as others have done, that the leishmania causing this cutaneous disease in South America is distinct from that of oriental sore both on morphological grounds and on account of the greater severity of the American disease.

C. M. W.

Unclassed.

Dendrinos (Georges). **Ueber einen neuen Krankheitserreger der Trypanosomengruppe.** [A New Pathogenic Organism of the Trypanosome Group.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Feb. Vol. 68. No. 1. pp. 29-30. With 1 plate.

The author records a new disease occurring in Greece in North Cephalonia. He describes three stages—first a stage of fever and general weakness, secondly a stage of splenic enlargement with outbreaks of fever, and thirdly a final stage wherein the spleen may extend to the iliac fossa, the liver enlarge and the fever reach 40° C. In this stage the body may be covered with a toxic exanthem. The disease, which may last three or four years, nearly always ends fatally. The condition is diagnosed by the finding of the parasite on puncture of the spleen. The parasite is described as occupying a position intermediate between the Piroplasmata and Leishmania. It is described as being elongated with one end blunt and the other pointed. Its length is 3μ and there are two nuclei as in leishmania, but these lie close together. A plate with five figures illustrates the paper.

[It certainly appears even from the character of the symptoms alone that the author is dealing with kala azar, which is known to occur in various parts of Greece. The description of the parasite corresponds exactly with certain forms of leishmania met with in both kala azar and oriental sore, and the figures in the plate being microphotographs show typical leishmania such as one expects to find in the spleen smears from cases of kala azar. It seems most probable, therefore, that the author is describing kala azar though he does not think so. He appears not to be aware that this disease exists in Greece and has only been able to compare his parasite (stained in smears with Romanowsky stain) with leishmania as seen in sections shown him by Prof. Marchand. There seems no reason to regard the parasite as other than a typical leishmania.]

C. M. W.

Rocha-Lima (H. da). **Beitrag zur Kenntnis der Blastomykosen.** [Contribution to the Knowledge of Blastomycosis.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1912. Vol. 67. No. 4. pp. .

This paper has to do with two parasites which have often been supposed to be of protozoal nature and closely related to the leishmania. The first one considered is the *Cryptococcus farciminosus*

causing the lymphangitis of horses. The author shows very clearly that the organism in question is none other than a yeast and that its resemblance to leishmania is only a superficial one owing to the fact that the parasite is found in numbers embedded in the protoplasm of mononuclear cells. Quite comparable appearances can be produced by the injection of yeasts into animals. The second parasite is the *Histoplasma capsulatum* which was found by DARLING in Panama in the tissues of one Chinaman and two negroes who had died of some obscure malady. The symptoms of the disease were wasting, irregular remittent fever, spleen enlargement and anaemia with leucopenia. Post mortem there was found an invasion of the endothelial cells of the small lymph and blood vessels with an enormous number of parasites which caused necrosis and cirrhosis of the liver, enlargement of the spleen, pseudogranulomata in the lung and ulceration of the large and small intestine, as well as necrosis in the corresponding lymphatic glands. As in the case of the Cryptococcus, the position within the cells produced a certain resemblance to leishmania invasion. In this case also the author shows that the Histoplasma is in reality a yeast-like organism and has nothing to do with the Protozoa. Both the Cryptococcus and the Histoplasma are closely related to the Blastomycetes.

C. M. W.

MALARIA.

Fry (A. B.). **First Report on Malaria in Bengal.** 42 + v. pp. With 10 maps, 11 charts, and numerous tables. F'cap. 1912. Calcutta: Bengal Secretariat Book Depot. [Price—Indian, Rs. 3-8; English, 5*s.* 3*d.*]

The author concludes from his investigations:—

1. The percentage of error in the figures for total births and total deaths in Bengal is small.

2. The heading "fever" includes all febrile diseases except small pox and the majority of cholera and plague cases. One third or less of the cases under the fever headings are due directly or indirectly to malaria.

3. The remaining two-thirds of the cases classed under the "fever" heading are made up of deaths from multifarious diseases and these in all probability do not vary greatly from year to year. The annual fluctuations of the "fever" death-rate are a measure of the variation of malaria mortality.

Malaria in Lower Bengal.—The Anopheline mosquitoes found were:—*Nyssorhynchus fuliginosus,* and variety *adiei; Nyssomyzomyia rossi; Myzorhynchus nigerrimus; Neocellia fowleri; Myzomyia culicifacies; Myzomyia listoni; Myzomyia albirostris; Myzorhynchus barbirostris; Nyssomyzomyia rossi,* variety *indefinata.*

The first named exists in greater numbers than all the other species put together. There is some reason to believe that it is a carrier of malaria.

He thinks that the splenomegaly in Lower Bengal is chiefly due to malaria and that the few cases due to kala azar may be safely neglected. An examination of 752 blood films showed 497 negative, 89 malignant tertian, 128 benign tertian, 20 quartan and 18 mixed infections. He points out with charts and tables that there is a large area in Lower Bengal in which malaria is hyper-endemic.

Statistics of Malarial Mortality in Lower Bengal.—There are marked annual variations in the malaria mortality, the true cause of which he could not ascertain. He was unable to find any correlation of this with rainfall, or rise in price of food. There is also a monthly variation in malaria mortality. July usually shows the minimum, while April and November or December show as a rule the maximum malaria death rate. The highest point in the curve representing malaria mortality is about two months later than the highest point in the curve representing the number of malaria cases. He thinks that the season of new infections from mosquitoes begins in July; the resulting maximum sickness is attained in October and the maximum mortality in December.

The Hyper-endemic Area (Jessore and Nadia).—Villages anywhere in these districts showed a spleen rate of over 50 per cent. Blood films gave an endemic index of 33 per cent.

Certain very swampy areas are more free from malaria than higher better drained areas. He is unable to account for this,

because of the lack of knowledge regarding the chief malaria-carrying mosquito in Bengal.

Previous Antimalarial Measures in Bengal.—The whole history is a melancholy record of energy and money wasted on totally inadequate schemes. The result of quinine distribution has been disappointing. The author agrees that village sanitation is at the root of the matter. The vast bulk of the people are illiterate and quite ignorant and apathetic regarding the value of quinine.

Malaria in Chota Nagpur.—September to October is the time of maximum death rate from "fever." The author examined three sections.

(1) In the flat plains of Manbhum, the villages are practically free from malaria and there are few mosquitoes.

(2) In the "Terai" region the villages situated at the foot of the plateau and on the slopes of the hills suffer from hyper-endemic malaria. There are no swamps and the draining streams are swift; yet mosquitoes are very abundant.

(3) The villages on the plateau itself harbour many mosquitoes due to their insanitary condition. He thinks that the anti-malaria problem in these districts is much more simple than in Lower Bengal.

Details are given of the conditions in other districts.

The appendix gives a report on malaria in Dum-Dum by Assist. Surgeon Chandra Ghosh.

D. Thomson.

Jamaica. **Annual Report of the Malaria Commission for the Year ended 31st March, 1912.**—38 pp. With 2 charts. F'cap. 1912. Jamaica: Government Printing Office, Kingston.

In Jamaica Sanitary Officers have been appointed in twenty districts which are under the control of the Local Board of Health in each parish. Courses of instruction have been instituted for the training of Sanitary Inspectors. Fourteen Medical Officers of Health have been appointed by the Parochial Board of fourteen districts. The duties of Medical Officers of Health are regulated by each Parochial Board and bye-laws have been drafted by the Central Board of Health for approval and adoption in the several parishes. The sanitary expenditure during the past year in Kingston was £6,024, while that for the rest of the island was £6,480. Swamp lands have been investigated, but it has been deemed inadvisable so far to undertake anything of the nature of a specific permanent improvement. Owing to the high prices demanded for sand dredgers for which tenders were invited, the intention to purchase one has had to be abandoned for the present. Many antimalarial measures however have been carried out, and further recommendations have been made in this respect.

Seventeen police stations have been screened with satisfactory results. Quinine is distributed to the children in the schools. Tables are given which show that the imported East Indian coolies are more susceptible to malaria than the Jamaica negroes. Further tables of the Police Returns show that malaria has diminished very markedly in the force during the last two years. Statements of expenditure and reports by the Secretary of the

Commission on inspections made during the period under review are appended.

[This is a very excellent and valuable report and shows that important steps have been taken to organise a more thorough system of sanitation in the island of Jamaica. Those interested should consult the original.]

D. T.

Firth (R. H.). **The Nature and Detection of Apyrexial Malaria.**—*Jl. R. Army Med. Corps.* 1913. Feb. Vol. 20. No. 2. pp. 129-134.

The author points out the importance of detecting apyrexial or dormant malaria, which is liable to cause much inefficiency among troops because it remains undiagnosed and in consequence is not treated. He defines dormant malaria as that apyrexial period in a malarial infection during which the parasites are still in the peripheral blood or deeper organs, but not present in the asexual stage in sufficient numbers to cause the clinical phenomena of fever or ague.

Regarding the methods of detecting apyrexial or dormant malaria he states that he is not familiar with the thick film method of Ross, but suggests that Thomson's work on the leucocytes in malaria may help to solve the problem. By making a total and differential leucocyte count frequently for two or three days, one may detect the violent fluctuations in the number of leucocytes and the high mononuclear percentage during leucopenia, described by that author. He was able to detect dormant malaria in one of his cases by that method.

Further corroborative evidence of the existence of this form of dormant malaria may be obtained by examining the urine for urobilin, according to the method of Plehn. A positive urobilin test indicates that blood pigment is being destroyed, and excluding other diseases this destruction is probably due to unsuspected malaria, especially if there is no pyrexia.

D. T.

Bignami (Amico). **Concerning the Pathogenesis of Relapses in Malarial Fevers.** [Translated by W. M. James.]—*Southern Med. Jl.* 1913. Feb. Vol. 6. No. 2. pp. 79-88.

Bignami points out that one of the most debated and obscure questions in the pathology of malaria is the genesis of relapses. These occur in all kinds of malarial infections, sometimes separated by brief intervals of apyrexia, at other times by long periods of latency. The hypothesis that relapses are due to parthenogenesis in gametes is by no means convincing, since this supposed phenomenon has been seen only by a few in spite of the fact that very many competent observers are constantly searching for it. The plates illustrating parthenogenesis by the few observers, Schaudinn, Karrewig and Neeb, are unconvincing. The translator, referring to these illustrations and also to those of Deaderick, Craig, and Harrison, agrees with the author that

they are insufficient to convince one that they represent parthenogenesis in gametes; he is inclined to believe that the forms depicted are atypical sporulating schizonts, frequently seen in anaemic blood.

The author thinks that there is more reason to believe that relapses are due to small numbers of the asexual parasites which have escaped the action of the specific remedy. These follow their accustomed life cycle without increasing in number for varying periods of time and cause no fever. When the patient however from some cause is debilitated, the parasites increase in number with rapid and progressive multiplication until they are numerous enough to cause fever; this constitutes a relapse. In support of this hypothesis he refers to the work of Ehrlich and his followers on trypanosomiasis. They found that trypanosomes in animals disappeared sometimes after the administration of certain drugs, arsenic compounds, etc. After some time however they reappeared, owing apparently to the multiplication of a few forms which had survived the action of the poison. Moreover these trypanosomes which had reappeared had developed some resistence to the drug administered.

He considers that he is justified in using a similar hypothesis to explain the obstinate resistance to quinine that is presented sometimes in relapsing malaria, especially in the clinical cases of chronic malarial infection.

D. T.

Rowley-Lawson (Mary). **The Extracellular Relation of the Malarial Parasite to the Red Corpuscle, and its Method of Securing Attachment to the External Surface of the Red Corpuscle.**—*Jl. of Experimental Med.* 1913. Mar. 1. Vol. 17. No. 3. pp. 324-343. With 6 plates (one coloured).

The author states that the malarial parasite is extracellular during its entire developmental cycle; that is, with the exception of the brief periods when it is free in the blood serum, it is attached to the outside surface of the red corpuscle.

The parasite secures its attachment by means of filamentous pseudopodia thrown out for that purpose. These pseudopodia overlie the red corpuscle in the form of a loop, and these give the young parasites a ring-like appearance. The parasite squeezes up that portion of the haemoglobin substance which lies within the boundary of the loop into a mound. If the parasite is attached near the edge of the corpuscle, it is often seen to project beyond the corpuscular boundary. Numerous microphotographs are given to support these statements.

The colourless unstained area often seen within a ring parasite is not a part of the plasmodium but represents that portion of the corpuscle from which the haemoglobin has been removed by its action. The small achromatic area sometimes seen surrounding the chromatin substance in the young parasite is part of the plasmodium. This area increases in size with the growth of the parasite and sometimes can be stained a delicate blue or pink.

The author has seen no evidence to indicate that the young parasites ever conjugate.

Every point in the paper is excellently illustrated by numerous microphotographs and a good bibliography is given. [The article is a valuable one since much difference of opinion exists among distinguished observers on the subject.]

D. T.

Ziemann (H.). **Ueber die künstliche Weiterentwicklung (in vitro) des Tertian-Malariaparasiten.** [The Cultivation of the Tertian Malarial Parasite.]—*Deut. Med. Wochenschr.* 1913. Feb. 20. Vol. 39. No. 8. p. 373.

This note forms a postscript to the author's paper on the same subject in the *Deutsche Mediziniche Wochenschrift*, 1913. No. 6. p. 260 (see this *Bulletin*, No. 9, p. 490). Ziemann states that he found sporulating parasites in his benign tertian malaria cultures, after 34 to 36 hours' incubation. This indicates very rapid growth and requires explanation, since the time required in the living patient is 48 hours.

D. T.

Poumeyrac. **Accès Pernicieux Palustre à Forme Pulmonaire.** [Clinique d'Outre-Mer.]—*Ann. d'Hyg. et Méd. Colon.* 1912. Oct.-Nov.-Dec. Vol. 15. No. 4. pp. 864-865.

The author describes an attack of malignant tertian malaria causing pulmonary symptoms in a soldier. Parasites were found in the blood, temp. 40·2° C. There was very severe dyspnoea with cyanosis of the face, and auscultation indicated marked pulmonary congestion. Quinine was given hypodermically; next day the temperature was normal and the signs of lung congestion had nearly disappeared; in six days the patient was well. About one month later the patient was brought into hospital with a similar attack. The fever and the pulmonary congestion again disappeared quickly under quinine treatment.

D. T.

Treatment.

Joyeux. **L'Hectine dans le Traitement du Paludisme.**—*Rev. de Méd. et d'Hyg. Trop.* 1912. Vol. 9. No. 4. pp. 227-240.

The author experimented with a drug called *"Hectine B" in the treatment of Syrian patients suffering from malaria in Upper French Guinea (West Africa). The diagnosis of malaria was undoubted, in most cases parasites being found in the blood. The drug keeps well in the tropics if not exposed to light; it is put up in ampoules for intramuscular injection. The author gives detail of twenty-one malaria cases in which he used this treatment and concludes that good results were obtained, although its effect was not so rapid as that of quinine. It is certainly

* Hectine is Sodii Benzo-Sulpho-*p*-aminophenylarsonas.

inferior to the latter, but he thinks that it might be useful where quinine is not tolerated, as he obtained a good recovery with it in a case of haemoglobinuric fever. It might also be employed in chronic malaria with anaemia since it acts as a general tonic.

D. T.

Webb (A. L. A.). **Notes of some Experiments made to Determine the Rate of Absorbability and Intensity of Action of Quinine given Hypodermically and by the Mouth, as shown by the Minimum-Lethal-Dose Method.**—*Jl. R. Army Med. Corps.* 1913. Mar. Vol. 20. No. 3. pp. 280-285.

The author attempted to confirm the experiments of MacGilchrist regarding the rate of absorption of quinine salts. The latter observer from experiments on guinea-pigs concluded that the lethality and therefore the absorbability of quinine was most rapid in the following order.

(1) Subcutaneous injection in extreme dilution (1-50);
(2) Oral administration during fasting;
(3) Oral administration with or soon after food;
(4) Subcutaneous injection in the strengths generally used for hypodermic injections (1-2 and 1-8).

The author in his experiments used monkeys instead of guinea-pigs. He found that with injections of 1-8 dilutions of quinine sulphate the minimum lethal dose for monkeys was between 0·2 and 0·25 grammes per kilo of the animal's weight. The results obtained with 1-5, 1-3 and 1-2 dilutions were very nearly the same as those with the 1-8 dilutions. All injections were given in the flank behind the shoulder. Such doses given by the mouth produced little effect and even doses equal to 0·4 grammes per kilo of the body weight did not even give a severe reaction when given orally. Administration by the mouth was performed by inserting a small wooden gag and then injecting the dose into the back of the fauces with an ordinary glass syringe.

It is concluded from the tables of experiments that the mode of administration giving the quickest action and the best absorption of quinine in monkeys is as follows, commencing with the most efficacious:—

(1) Injections of 1-8 dilutions
(2) ,, 1-5 ,,
(3) ,, 1-3 ,,
(4) ,, 1-2 ,,
(5) Oral administration with or without fasting

He does not agree therefore with MacGilchrist's statement that "subcutaneous and intramuscular injections in solutions of the usual strength (1-2 to 1-8) are inferior to quinine by the mouth in rapidity of action and thoroughness of absorption"; but concludes on the contrary that the drug in such dilutions, whether given by intramuscular or hypodermic injection, is more efficacious in malaria than if given by the mouth.

D. T.

Waters (E. E.). **The Value of Amorphous Cinchona Alkaloid in Malaria.**—*Indian Med. Gaz.* 1913. Mar. Vol. 48. No. 3. pp. 89-91. With 13 charts.

The author describes (with charts) a number of malaria cases which he treated with the " amorphous alkaloid " found in cinchona bark and another series of cases which he treated with " cinchona febrifuge." " Cinchona febrifuge " is a mixture of all the substances contained in cinchona bark, and contains four alkaloids, quinine, cinchonidine, cinchonine and quinidine. There is also a fifth substance which is called " amorphous alkaloid " and has been stated by Prain to be much more effective than even pure crystallized quinine. An average of sixteen grains of the " amorphous alkaloid " was sufficient to stop the fever of malaria in a series of 62 cases. The fall of temperature was very prompt even though the fever had persisted for some days before this treatment. Similar experiments with quinine salts showed that 45 grains of quinine sulphate were necessary to stop the fever in three days, and so it is concluded that the amorphous alkaloid is three to five times as effectual as quinine sulphate.

The " amorphous alkaloid " has no unpleasant effects; it can be given in small tablets, and is rapidly effective as well as inexpensive (four rupees per pound).

In the series of cases treated with " cinchona febrifuge " it was noted that 30 to 40 grains were necessary to stop the fever.

D. T.

Memmi (G.) & Cantieri (C.). **Il " 606 " nella Cura della Malaria. Studio Critico e Osservazioni Personali.** [" 606 " in the Treatment of Malaria.]—*Riv. Crit. Clin. Med.* 1913. Jan. 4. Vol. 14. No. 1. pp. 1-8; Jan. 11. No. 2. pp. 17-25; Jan. 18. No. 3. pp. 33-41; Jan. 25. No. 4. pp. 49-59. With 10 charts.

The authors give a very careful and full account of ten cases of malaria which they treated with intramuscular injections of " 606." Eight of the cases were aestivo-autumnal malaria and two were benign tertian; six were relapses (one benign tertian and five aestivo-autumnal). Three were primary infections and one doubtful; one of these was benign tertian.

The injections of " 606 " were made either during the period of apyrexia or during fever, at the height or fall, and no inconvenience whatever was produced. Each had a single dose of from 0·3-0·6 gm.

Their conclusions regarding the action of the drug in these cases are as follows:—

(1) It was insufficient to check the attack of fever in nearly all the cases and it did not prevent relapses.
(2) It did not show any parasiticidal action in malaria.
(3) The general condition of the patients did not benefit to any extent under the treatment.
(4) The injection of " 606 " did not give good results in their cases even when small doses of quinine (0·5 grammes) were given in addition.

D. T.

Mosquito Prophylaxis.

Nicholls (Lucius). **Some Observations on the Bionomics and Breeding-places of Anopheles in Saint Lucia, British West Indies.** —*Bull. Entom. Research.* 1912. Nov. Vol. 3. Pt. 3. pp. 251-267. With 4 plates.

The author describes the natural features of St. Lucia, and goes on to discuss the developmental stages of *Anopheles argyrotarsis* and *Anopheles albimanus*, which are the two principal malaria carrying mosquitoes in that island. He points out that the larvae of these are subject to a number of diseases due to protozoa (chiefly Vorticellidae). These diseases alter the appearance of the larvae very much, causing loss of hairs, etc. If a diseased larva survives, a long time will be taken for its development. On two occasions from a large number of diseased larvae of *A. albimanus* he obtained two small stunted adults after 28 and 33 days respectively. The colour and markings on the larvae also vary according to the nature of the pools in which they are found.

The length of the life cycle of these mosquitoes depends on the nature of the breeding ground. In unfavourable conditions the period required for their development is longer than when the conditions are favourable.

	Under favourable conditions.	Maximum under unfavourable conditions.
Egg stage... ...	1½-2 days	2½ ? days
Larval period ...	11-14 ,,	31 or more days
Pupal period ...	2 ,,	2½ ? days
Total	14½-18 ,,	36 or more days

The length of life of the imago is very difficult to determine; but probably there are very few which exist for more than six weeks. A fortnight is the average length of life in moderate-sized cages, with an abundant food supply. This does not include males which rarely live for a week.

With regard to general bionomics, he points out that a great struggle for existence goes on among these larvae in pools, depending on the amount of food supply and the presence of natural enemies in the pools. He found that the conditions in pools changed greatly during the year. Diseases caused by protozoa and algae were most prevalent in non-permanent pools of stagnant water which had lasted over ten weeks; less or absent in permanent pools of water. The female anophelines appear to have some power of selecting the most favourable pools for depositing their ova. The methods for ascertaining the distribution of larvae, the classification of breeding grounds and the effect of rainfall on the number of anophelines are described.

In conclusion, the author believes that all efforts directed to mosquito reduction should be founded, not on generalisations which show theoretically where the insects ought to breed, but upon knowledge of their breeding grounds obtained by a prolonged and thorough study of all collections of water which are formed during the year. He also shows the necessity

for carrying out examinations throughout the year. If anti-mosquito measures be started without first making a study of the breeding places, the efforts may be useless and in some cases even harmful.

D. T.

Legendre (J.). **Destruction des Culicides a l'Aide du Filet.**—*Bull. Soc. Path. Exot.* 1913. Jan. Vol. 6. No. 1. pp. 43-47.

The author describes the value of a net (resembling a butterfly net) in keeping human dwellings free from mosquitoes, thereby rendering them more comfortable to the occupants. A native can be taught easily to use this net effectively. He gives an account of four experiments, in which he liberated a certain number of mosquitoes in a house. The windows and doors were closed and a native with the net was sent in to capture them. Thirty minutes were required for this in the first experiment. In experiment (2) 360 culices were caught in 40 minutes. In experiment (3) 376 mosquitoes were captured in 50 minutes and not one could be found in the dwelling after this time; and in experiment (4) 137 were caught in 35 minutes. The arming of natives with such nets would contribute very materially to the prevention of diseases transmitted by mosquitoes. The method is very valuable in freeing dwellings, occupied by yellow fever cases, of *Stegomyia fasciata*, especially large dwellings with large openings to the exterior, where chemical fumigation is very difficult; and it possesses an advantage over the fumigation method in that it is not necessary to remove the patient.

D. T.

Orenstein (A. J.). **Mosquito Catching in Dwellings in the Prophylaxis of Malaria.**—*Amer. Jl. Public Health.* 1913. Feb. Vol. 3. No. 2. pp. 106-110.

Mosquito-catching by hand within dwellings is a measure of great value in the prophylaxis of malaria. It is especially applicable to temporary camps.

This measure is adopted in the Panama Canal Zone in places where there are temporary camps and the expense of drainage, &c., would be prohibitive. In one instance it reduced the malaria rate from 14 per cent. a week to about 0·3 per cent. per week. At the Monte Lirio camp in the Canal Zone this is about the only measure relied upon to keep down the malaria rate; yet it reduced this to a point as low as that in other parts of the Zone, where the breeding places of anophelines are destroyed.

The mosquitoes are caught by trained negroes in "chloroform tubes" such as are used by entomologists. They are also killed by means of a "slapper" made of a six-inch square of wire gauze attached to a two-foot stick. If the dwellings are screened, the catching should be done early in the morning and in the evening. If the dwellings are not screened and the anophelines are abundant, a search for anophelines should be made four or five times a day.

In order that the catching may be efficiently done, it is necessary to have the dwellings well lighted and the walls painted a light colour or whitewashed. In dark dwellings some form of portable illumination should be used. In screened buildings hand catching may be supplemented by properly designed and installed mosquito traps.

D. T.

UNCLASSED.

LALOR (N. P. O'Gorman). **A Teleological Working Theory of the Asymbiotic Relations of the Malarial Plasmodium to its Alternative Hosts—Man and the Anopheles Mosquito.**—*Indian Med. Gaz.* 1913. Feb. Vol. 48. No. 2. pp. 52-54.

The author believes that he has discovered a law which explains the periodicity and other phenomena of the prevalence of malaria. It is that "the viability of a parasite through its life stages in an insect host is the result of an asymbiotic relation between the individual parasite and the individual host, the terms of which are those of their relative vital potential. If the relative vital potential of the parasite is too high the host dies; if the relative vital potential of the host is too high the parasite is destroyed." For the details of his argument the paper must be consulted.

D. T.

CAJOZZO (G.). **Ossido di Carbonio e Malaria.** [Carbon Dioxide and Malaria.]—*Gazz. d. Ospedali e d. Cliniche.* 1913. Jan. 16. Vol. 34. No. 7. pp. 65-67.

The author believes that the malarial parasite can only attack a person in whom the functional activity of the red blood corpuscles is disturbed. Amongst the agents which can disturb the red corpuscles he places carbonic acid gas produced by vegetable decomposition in fertile malarial districts. [The author brings forward no scientific observations in support of his contention.]

D. T.

SLEEPING SICKNESS.

The Trypanosome of Man in Rhodesia and Neighbouring Regions.

Beck & Weck. **Die menschliche Trypanosomen-Krankheit am Rovuma in Deutsch-Ostafrika.** [Human Trypanosomiasis on the Rovuma in German East Africa.]—*Arch. f. Schiffs. u. Trop.-Hyg.* 1913. Mar. Vol. 17. No. 5. pp. 145-160.

In July and August, 1911, a number of sudden deaths were reported from a village on the Sassawara river in the Ssongea district of German East Africa; this district marches on the south with Portuguese East Africa, the Sassawara draining to the Rovuma. A large number of blood smears were sent to the laboratory at Daressalam and trypanosomes were found in the blood from two women. The authors were therefore sent to investigate. On repeated examination of the inhabitants of the village, 110 in number, they found trypanosomes in the blood of four, one of whom was a girl who appeared to be in good health. They looked carefully for *Glossina palpalis* in the neighbourhood; this species was not present, but *Glossina morsitans* was very common. In a neighbouring village they found four other cases of trypanosome infection and at a place six days' march away they found others. Enlargement of the glands was unusual in these villages. Here again *Glossina morsitans* was common and *palpalis* was absent. Between November 1911 and September 1912 twenty cases in all were found near the Rovuma river, one of which came from Lake Nyasa. Twelve of these were collected in a camp and treated with atoxyl; eight are now dead, three of whom were not treated. Nine patients are now under treatment. In the great majority trypanosomes could be driven only temporarily out of the blood by atoxyl treatment, which was carried out according to Koch's method. The blood was examined at least twice a week in thick films. It was found that as a rule the trypanosomes reappeared one or two days after an injection. In some patients trypanosomes were fairly numerous, but in the greater number they were very few, sometimes only one being found in the whole preparation. No slide was considered negative unless it had been searched for twenty minutes.

The clinical picture of the disease varied considerably; some patients had no symptoms at all; somnolence was seen in one patient in the last eight days of life. Details follow of each case. Some account is given of the morphology of the parasites. Inoculation experiments were made with several species of animals; it was noticed that in all the incubation period was short. It was observed that the trypanosomes in the blood and organs, especially the lungs, liver, and heart, in dogs, rats, and monkeys often differed considerably from the forms in man; the difference appears to have consisted in the presence of stumpy forms with the blepharoplast near the nucleus. They never observed these organellae transposed. They consider that in their morphological and biological properties the trypanosome in these cases

differs both from *T. gambiense* and *T. rhodesiense* and they suggest the name *Trypanosoma rovumense.* [Taute has shown that this trypanosome corresponds with *T. rhodesiense* (this *Bulletin,* No. 9, p. 513.] They think that, owing to the small number of cases, the disease is not likely to spread or to be introduced into other districts.

With regard to preventive measures, if the number of cases increases it will be necessary to move the villages into a fly-free district. Clearing is impossible because the fly is so widely spread. They recommend regular visits to the infected and suspected districts for the detection of the sick and carriers; collecting of these in a camp and treatment of them with atoxyl; the setting up of control stations for the examination of caravans going to or from the coast; and the reporting of deaths in the affected district.

A. G. B.

i. Fleming (A. M.). **Report on the Fly Area and the Outbreak of Trypanosomiasis in the Sebungwe District.**

ii. May (A.). **Sleeping Sickness in the Luangwa Valley.** Reports to the British South Africa Company. [MSS.]

i. On August 1st, 1912 it became known that human trypanosomiasis was present in Southern Rhodesia, a European from the Sebungwe District having been found in England to be infected. The author, Dr. F. O. Stohr, and Mr. Jack visited the region in question. An account is here given of their investigations. The distribution of tsetse fly is detailed and discussed. An account is given of the cases of infection discovered; these now number twelve. The natives within the fly belt have no cattle, few dogs, and only small herds of sheep and goats; a certain percentage of these was found to be infected with trypanosomes. Rabbits were inoculated with a human strain, a dog strain, and a goat strain, and were forwarded to Mr. Bevan. All the persons found to be infected had resided in, or recently visited the Busi river, a tributary of the Sengwe. The number of infections is considered small in comparison with the total native population, who are freely bitten by fly. Evidence of natives is given as to the date of infection of man, whether recent or remote. The natives in the infected area are to be moved. The author thinks that, if the money could be found, the best method of dealing with the district would be by systematic deforestation from without inwards, by breaking up large tracts of ground, and the cultivation of sugar, cotton, and other products. The conclusions arrived at were as follows—

"1. That trypanosomiasis in men undoubtedly exists in the Sebungwe District.

"2. That the infection is small in relation to the population.

"3. That the area of infection would appear to be limited to certain villages along the banks of the Busi River.

"4. That whether we are dealing with *Trypanosoma rhodesiense* or *Trypanosoma gambiense* or some new trypanosome is still unproved.

"5. That though fly sickness in stock has been known for many years, infection of man would appear to be of comparatively recent origin.

"6. That in order to prevent the further spread of trypanosomiasis in man within this area, or the infection of adjacent fly belts in Southern Rhodesia, the wholesale depopulation of this fly belt is advisable.

"7. That the policy to be adopted in dealing with this depopulated area in the present state of our knowledge must be guided largely by financial considerations.

"8. That unless steps are taken to prevent the spread of the fly it will probably, given favourable conditions, spread beyond its present boundaries."

ii. May has recently re-examined the population on and near the Luangwa river, Northern Rhodesia. His report is dated December 13th, 1912. His object was to compare the results with those of similar examinations in 1910 and 1911. 66 villages were visited and 3,340 people seen. The total result was that fewer cases were found than in 1910, nine as against ten. The adult death rate was calculated at 28 per thousand, but most of the deaths could be attributed to causes other than trypanosomiasis. The author thinks that the trypanosomiasis death rate may be put at 8 per thousand and that there is nothing to show that the disease has spread or shows even a tendency to become epidemic. He thinks that the present restrictions in this area can shortly be modified with safety.

A. G. B.

Shircore (J. O.). **Nyasaland Trypanosome Fever.**—*Trans. Soc. Trop. Med. & Hyg.* 1913. Feb. Vol. 6. No. 4. pp. 131-142. With 2 charts.

In this paper a full account is given of the symptoms of human trypanosomiasis in Nyasaland (cf. *Sleeping Sickness Bulletin*, Vol. 4, p. 262). It is noted that the tendency to sleep at odd hours is not common, but a typical somnolent stage of some three weeks has been recorded in three instances. Whereas gland enlargement in the posterior triangles may or may not be present, the epitrochlears are almost invariably palpable and sometimes puncturable. This enlargement was absent in only one of 21 cases. Interstitial keratitis was present in five out of 29 cases. The changes in the blood were studied in twelve cases; the red blood cells were found to be between 3,300,000 and 3,500,000 per cmm.; the haemoglobin varied between 35 and 40 per cent.; the colour index in two cases was about 0·5; the white corpuscles were between 7,000 and 12,000 per cmm. The lymphocytes were increased at the expense of the polymorphonuclears except in the last stages or even earlier. The large mononuclears were between 10 and 14 per cent. Oedema of the glottis and lungs is noted as not uncommon. The average duration of the disease was found to be four and a half months; a duration of six months was exceptional. The author attaches much importance to the examination of fresh coverslip preparations of blood. He found that when trypanosomes had been once observed they were invariably found at every subsequent examination. He concludes that the trypanosomes are always present and especially so during the last month.

He differentiates the disease in Nyasaland from the acute form in Uganda by the facts that in Nyasaland there is nearly always a very definite and unusually severe onset; the diagnostic value of the glands in the posterior triangles is practically nil; a large percentage of the cases show interstitial keratitis; and in 27 cases examined trypanosomes were found in the peripheral blood whenever looked for. With regard to prognosis he says that the first well-defined diminution in the frequency of the pulse rate indicates that the case is on its downward course and that the vital resistance has been overcome. A table is given showing the state of the posterior cervical glands and the epitrochlears in 21 cases; glands were palpable in 66·6 per cent. in the posterior triangles, in 95·23 per cent. in the epitrochlear region. As a result of the examination of one hundred healthy persons for enlargement of the epitrochlears it was found that they were palpable in 47 per cent.

Of the charts appended one shows a regular intermittent temperature, the other a less regular type.

[The acute inflammatory swelling of the skin of the neck, described by Stannus and by Sanderson, appears to be met with in Europeans and only seldom in natives.]

A. G. B.

Hearsey (H.). *Nyasaland Sleeping Sickness Diary.* 1912. Dec. 31. Part 19. 6 pp.

During the quarter, October to December 1912, fifteen additional cases of sleeping sickness were reported, fourteen in the Sleeping Sickness Area and one from the Marimba district. This makes a total of 108 cases. There follows an account of most of the fresh cases; seven were dead at the date of the Report. Clearings have been made round all the villages in the proclaimed area and Shircore has reported that they have been markedly successful in banishing the flies. During eight months' investigations in adjoining districts only one case of infection has been found, but the author thinks that such cases probably exist.

A. G. B.

Stephens (J. W. W.) & Fantham (H. B.). **Further Measurements of** *Trypanosoma rhodesiense* **and** *T. gambiense.*—*Ann. Trop. Med. & Parasit.* 1913. Mar. 31. Vol. 7. No. 1. pp. 27-39.

In the present series of measurements the authors have measured, always from a single animal, a rat, 100 trypanosomes each day for the first ten days of the infection. In answer to criticisms of their modification of Bruce's method they say that it is suitable for use in the laboratory, if not in the wilds, and is acknowledged to be more accurate. They give first a detailed table of measurements of *T. rhodesiense,* 1,000 non-dividing individuals, then a summary of these measurements, and a table which is compiled from them.

Table III.—*T. rhodesiense,* in which the trypanosomes are arranged in Bruce's three groups (a) 13-21μ; (b) 22-24μ; (c) 25μ and upwards.

Day.	1	2	3	4	5	6	7	8	9	10	Totals.
Stumpy, 13–21μ ...	12	41	37	45	17	16	53	15	9	8	253
Intermediate, 22–24μ	25	19	40	28	31	40	29	18	16	21	267
Long, 25–36μ ...	63	40	23	27	52	44	18	67	75	71	480
	100	100	100	100	100	100	100	100	100	100	1,000

This table shows clearly the great variations in the figures for each group on particular days, which makes it obvious that when a sample is taken at random from an animal on any day an erratic factor is introduced. The distribution by percentages in respect to length of the 1,000 non-dividing trypanosomes is expressed in a curve.

Corresponding tables are then given for *T. gambiense.*

Graphical representation of the distribution of the lengths of 1,000 *T. gambiense* from one rat, and of 1,000 *T. rhodesiense* from one rat.

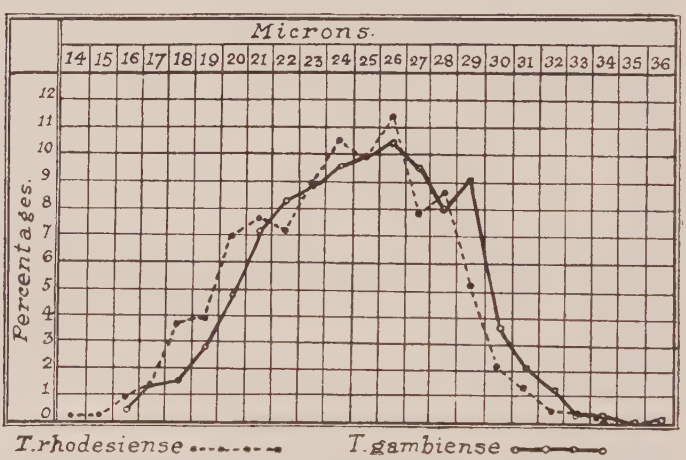

Table VI.—*T. gambiense,* in which the trypanosomes are arranged in Bruce's three groups.

Day.	1	2	3	4	5	6	7	8	9	10	Totals.
Stumpy, 13–21μ ...	17	1	25	10	23	29	57	6	5	9	182
Intermediate, 22–24μ	40	16	29	23	33	49	33	15	20	12	270
Long, 25–36 μ ...	43	83	46	67	44	22	10	79	75	79	548
	100	100	100	100	100	100	100	100	100	100	1,000

Here is noted a similar variation in the figures for each group. There follows a curve for *T. gambiense.*

T. gambiense and *T. rhodesiense* are then compared in three tables, one of which is here reproduced.

Table VIII.—Comparison of distribution of the trypanosomes according to Bruce's groups.

	13–21μ.	22–24μ.	25μ and upwards.
T. gambiense...	18·2 %	27·0 %	54·8 %
T. rhodesiense	25·3 %	26·7 %	48·0 %

The average length of the specimens of *T. rhodesiense* measured was 24·12μ, of *T. gambiense* 24·87μ.

The difference of opinion as to procedure and the different results obtained are attributed to the fact that these trypanosomes are dimorphic; such difficulties probably do not arise in the case of a monomorphic trypanosome. The size of the sample is discussed; it is considered that one of 100 is fairly reliable when trypanosomes are plentiful in the blood. The day of infection in an acute trypanosomiasis is very important in determining whether the trypanosomes are short or long, as reference to Table III or VI will show. It is noted that there is a fair correspondence between the curves of Bruce and others and those of the authors, but none between those of Kinghorn and Yorke and the authors'. They believe that these differences must be due to difference of method, but they note also the possibility that trypanosomes direct from the natural vertebrate hosts or the fly have a different character from those that have been maintained in laboratory animals. The authors' results for *T. rhodesiense* are in accord with their previous measurements (*Sleeping Sickness Bulletin*, Vol. 4, p. 257) and show the consistency of their method. The conclusion is as follows—

"We must admit that we had hoped to be able to distinguish between the two species, *T. rhodesiense* and *T. gambiense*, by measuring one thousand specimens of each organism. Though these biometric results are not sufficiently conclusive, we think that it is generally admitted that the two species are distinct.

"Microscopically, the two trypanosomes are indistinguishable except by the posterior nuclear character of *T. rhodesiense*. We believe that a curve only expresses graphically what the eye can appreciate under the microscope, and that if two trypanosomes cannot be distinguished microscopically, we shall not be able to do so by measuring them. However, provided that further experience enables observers to agree as to the best procedure, it is no doubt a great advantage to have a correct graphical expression for what is otherwise only an impression, although it may be a quite accurate one. Further, these measurements should not be regarded as useless, as they will undoubtedly form the basis (provided all the protocols are given) for a critical statistical investigation in the future."

A. G. B.

Bruce (David), Harvey (David), Hamerton (A. E.), & Lady Bruce.—**Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland. I. The Human Strain.**—*Proc. Roy. Soc.* 1913. Apr. 7. Series B. Vol. 86. No. B 587. pp. 285-302.

The object of the paper was "to study as many individual strains as possible" in order to gain "a general idea of this important species of trypanosome." Five human strains have

been studied, four from natives in the sleeping sickness area, Nyasaland, the fifth from an European who contracted the disease in Portuguese East Africa. No difference can be made out in regard to the general morphology on comparing the five strains. "The same posterior nuclear and blunt ended forms are present in all."

The five strains were compared biometrically, and the results set forth in the following table:—

Table XVII.—Measurements of the Length of the Trypanosomes of the five Human Strains. The trypanosomes have been taken from various animals.

Date.	Strain.	Name.	Number of trypanosomes.	Animals.	In microns.		
					Average length.	Maximum length.	Minimum length.
1912 ...	I	Mkanyanga	1220	Various	24·1	36·0	14·0
1912 ...	II	E————	1500	,,	22·2	36·0	15·0
1912 ...	III	Chituluka	1500	,,	26·1	38·0	15·0
1912 ...	IV	Chipochola	1000	,,	22·5	34·0	15·0
1912 ...	V	Chibibi ...	1000	,,	22·4	37·0	15·0
			6220		23·5	38·0	14·0

The various animals used for inoculation were the goat, monkey, dog, rat and sometimes the sheep.

The "difference in average length may be due to slight variations having taken place in the different strains, resulting from the passage through more or less resistant man. There is no evidence that this variation is due to treatment by atoxyl or other drugs. It has been shown that the same strain grown in two animals of the same species [*e.g.*, rats] gives like results."

Table XVIII.—Measurements of the Length of the Trypanosomes of the Five Human Strains. The trypanosomes have been taken from the rat alone.

Date.	Strain.	Name.	Number of trypanosomes.	Animal.	In microns.		
					Average length.	Maximum length.	Minimum length.
1912 ...	I	Mkanyanga	600	Rat	25·1	35·0	16·0
1912 ...	II	E————	1000	,,	23·1	32·0	17·0
1912 ...	III	Chituluka	1000	,,	26·4	38·0	15·0
1912 ...	IV	Chipochola	500	,,	22·5	34·0	15·0
1912 ...	V	Chibibi ...	500	,,	24·0	32·0	18·0
			3600		24·2	38 0	15·0

The five curves of measurements of the strains prepared by the authors were compared with each other and with the curves of

T. rhodesiense given by Stephens and Fantham (*Sleeping Sickness Bulletin*, Vol. 4, p. 261) and Kinghorn and Yorke (*loc. cit.*, p. 170). Curves I. and III. were alike and coincided with that prepared by Stephens and Fantham from the case of Armstrong in Liverpool, whereas Curves II., IV. and V., approached more to the type described by Kinghorn and Yorke from the Luangwa Valley.

The percentages of posterior nuclear forms found in the trypanosome of the human strain is set forth in the following table:—

Table XX.—Comparison of the Percentages of Posterior-Nuclear Forms found among the Short and Stumpy Varieties of the Trypanosome of the Human Strain.

Experiment No.	Strain.	Name.	Animal.	Percentage among short and stumpy forms.
—	I	Mkanyanga ...	Rat ...	34·1
728	II	E———	„ ...	9·3
953	III	Chituluka... ...	„ ...	10·3
1337	IV	Chipochola ...	„ ...	3·3
1660	V	Chibibi	„ ...	32·0
			Average ...	17·8

The authors' conclusions are as follows:—

"1. The five human strains of this trypanosome, isolated from four natives in Nyasaland and one European in Portuguese East Africa, belong to the same species.

"2. This species is *T. rhodesiense* (Stephens and Fantham).

"3. Evidence is accumulating that *T. rhodesiense* and *T. brucei* (Plimmer and Bradford) are identical."

H. B. Fantham.

Blacklock (B.). **A Study of the Posterior Nuclear Forms of *Trypanosoma rhodesiense* (Stephens and Fantham) in Rats.**—*Ann. Trop. Med. & Parasit.* 1913. Mar. 31. Vol. 7. No. 1. pp. 101-112.

The author reviews the work done on trypanosomes showing posterior nuclear forms. His own experiments were made on rats, arranged in four groups of six each, all inoculated from a guinea-pig infected with *T. rhodesiense*. The number of parasites inoculated was estimated at one million, four millions and eight millions. "No definite variation in either incubation or duration could be attributed to the relative numbers of trypanosomes injected."

The blood of the animals was examined daily. "The first trypanosomes which appeared in the peripheral blood of each rat were of the long and slender, or intermediate types. Subsequently, short forms made their appearance, and after a few days posterior nuclear forms." The forms showing the nucleus quite posterior appeared last.

Blacklock states that "posterior nuclear forms were found in all cases in the preliminary count," thus showing the constancy of this feature in the strain.

The author discusses the significance of the posterior nuclear forms in *T. rhodesiense*.

His conclusions are:—

"1. Posterior nuclear forms first appear in the blood of rats infected with *T. rhodesiense* from the sixth to the tenth day of the disease, taking a count of a thousand trypanosomes.

"2. They increase in numbers in the later stage of the disease.

"3. They increase relatively to other forms of trypanosome.

"4. They cannot be explained as the result of either faulty technique or degeneration.

"5. They show definite powers of resistance to disintegration in the cadaver of the animal host.

"6. The presence of posterior nuclear forms may be due to:—

"(*a*) The occurrence of such forms as a constant constituent of certain strains.

"(*b*) A mixed infection.

"(*c*) Certain unexplained influences in the blood environment, affecting the parasites.

"(*d*) The transmitting agent.

"7. There are, at present, stronger arguments against the last three explanations of their presence than against the first."

H. B. F.

Trypanosoma brucei.

Stephens (J. W. W.) & Blacklock (B.). **On the Non-identity of *Trypanosoma brucei*, Plimmer and Bradford, 1899, with the Trypanosome of the Same Name from the Uganda Ox.**—*Proc. Roy. Soc.* 1913. Mar. 6. Series B. Vol. 86. No. B 586. pp. 187-191.

The authors review briefly the statements regarding the morphology of *Trypanosoma brucei* made by:—Bruce (? 1896) in his report on the Tsetse-fly Disease or Nagana in Zululand; Kanthack, Durham and Blandford (1898); and Plimmer and Bradford (1900, 1902). These statements as well as the figures and photographs available show that *T. brucei* is practically monomorphic, very few trypanosomes being at all stumpy.

Next the authors analyse the paper of Bruce and his collaborators (1911), who compared *T. brucei* from Uganda with *T. brucei* from Zululand, and came to the conclusion that the strains were the same. Then the article of Laveran (1911) on the identification and classification of mammalian trypanosomes is analysed. Laveran placed *T. brucei* in a group which always showed a free portion to its flagellum, in contrast with *T. gambiense*.

Finally, Stephens and Blacklock examined the strains maintained at the laboratories of the Liverpool School of Tropical Medicine and derived from (1) the Zululand strain of Kanthack, Durham and Blandford, and Plimmer and Bradford, and (2) the Uganda strain of Bruce. The authors state that:—

(*a*) "The Zululand strain is *typically monomorphic*. The trypanosomes are long, with a long free flagellum." Laveran's strain of *T. brucei*, derived from Ehrlich, was also verified as

monomorphic. Further, the Zululand strain as seen in old slides lent by Nuttall, Skinner, and Plimmer, was found to be monomorphic.

(*b*) "The Uganda strain, on the contrary, is *typically dimorphic*, i.e., besides the usual long forms of trypanosomes, stumpy forms are readily found, even in abundance occasionally, when the infection is well marked." Bruce (1912) states that this trypanosome has 26 per cent. of non-flagellated forms.

Stephens and Blacklock write "that it is impossible to match a typical Uganda slide by any slide from the Zululand strain."

Mesnil remarked that the Uganda strain maintained in mice showed very few stumpy forms, but Mesnil's strain reinoculated into guinea-pigs showed many stumpy forms. The Zululand strain, on the other hand, is monomorphic in guinea-pigs, rats and rabbits.

The authors consider that the preceding results may be explained by one or other of three possibilities:—

(1) The possibility of confusing the strain during the course of inoculations extending over years. This, however, seems untenable.

(2) That the strain examined by Bruce in Zululand may not have been the same as that sent to England. This may be possible.

(3) "That the strain originally sent to England was dimorphic, but that it has now become monomorphic." The dimorphic strain might be a mixture of long and stumpy trypanosomes, and the stumpy forms have now died out.

The authors cannot decide definitely between these views.

In conclusion they write:—

"We come back, therefore, to the fact of which we ourselves have no doubt, viz., that the trypanosome that Plimmer and Bradford worked with, and which they named *T. brucei* in 1899, is certainly now a monomorphic trypanosome, and is not the same as the trypanosome from the ox described under the same name by Bruce and others in Uganda.

"We believe, then, that the facts we have brought forward prove the non-identity of the Zululand and Uganda strains.

"In order to avoid confusion, we think it advisable that this Uganda trypanosome should be re-named. We therefore propose for it the name *T. ugandae*."

H. B. F.

Treatment.

Ranken (H. S.). **A Preliminary Report on the Treatment of Human Trypanosomiasis and Yaws with Metallic Antimony.**—*Proc. Roy. Soc.* 1913. Mar. 6. Series B. Vol. 86. No. B 586. pp. 203-215.

The use of precipitated metallic antimony, in a state of finest division, was devised by Plimmer for the treatment of trypanosomiasis. The results of experiments on infected animals with this substance have appeared at various times in the *Sleeping Sickness Bulletin* (*e.g.*, Vol. 3, p. 18). The metal is given intravenously and causes no irritation of the tissues. It was first used in cases of sleeping sickness by R. J. C. Thompson at the Yei sleeping sickness camp, but the cases were not fully investi-

gated. The author's series of cases was treated by him at Yei in the Lado Enclave since October 1911. During the past year 76 newly admitted cases have been treated with antimony, either alone or combined with salvarsan or atoxyl, and shorter courses of antimony have been given to 143 old cases previously treated with atoxyl and other substances. Over 1,400 intravenous injections have been given; amongst the first 150 three deaths occurred which were probably due to the treatment.

"The method of administration is the same as that of an ordinary intravenous injection of saline solution given hydrostatically through a needle of somewhat large bore.

"The dose of antimony is stirred with about half an ounce of normal saline in a small glass mortar and becomes a temporary suspension. Two ounces of saline are then poured into the funnel and tubing, the needle is inserted into any vein in the forearm and the clip opened. As soon as it is seen that the saline is flowing freely into the vein, and there is no swelling round the site of the puncture, the suspension of antimony is poured into the funnel and the mortar is washed out, with a little more saline, into the funnel in order to leave no residue. The antimony is allowed to run into the vein, the funnel being gently shaken from time to time, and, when it is on the point of becoming empty, more saline is poured in. The window in the rubber tubing should be watched, and after all traces of antimony have passed it some more saline is allowed to run in to clear it out of the part of the tubing below the window; the clip is then closed and the needle withdrawn. About six ounces of saline seems to be a sufficient quantity, and the time occupied in giving an injection varies from three to seven minutes—depending on the calibre of the vein and the bore of the needle employed.

"I have found it possible, without any hurry, to give as many as 10 injections in an hour; I mention this to show that this method of treatment is feasible on a large scale."

The usual dose was 1 grain. The author thinks that in selected cases one and a half or even two grains may be safely given. Four days would seem to be the most suitable interval between doses; they have frequently been repeated on the third day. The usual course of treatment was five doses at intervals of four days, with a short course of three doses extending over nine days after an interval of six weeks. A table shows the results of the treatment with antimony alone of 35 cases; in fifteen there were no symptoms other than enlargement of the cervical glands; seventeen had also fine tremor of the tongue. They were taken just as they came. Microscopical examination was the only available method of controlling the results. Blood and gland juice were examined in all cases by three observers, the total time of each examination being one and a half hours. Of the 35 cases four are dead, two have deserted, five have relapsed, and the remaining 24 are improved, microscopic examination being negative up to the date of writing. Two only of the four deaths could be connected directly with the treatment. Two of the patients who relapsed were very susceptible to antimony and were unable to take doses at shorter intervals than a week. Of the 24 improved cases it is thought that probably some will relapse; they are at present being kept without further treatment.

Ten cases were treated by antimony and salvarsan; eight have shown definite improvement. Thirty-one patients have been

treated by antimony and atoxyl, in such a way that they had continuous treatment for rather more than three months. It is too early to speak of the results.

Some patients have a high degree of susceptibility to these injections. The following symptoms may be seen in ordinary patients—fever (*réaction thermique*); soft pulse (fall in blood pressure); diuresis; cough, lasting as a rule five or ten minutes, rarely twelve hours or more; pain in the xiphisternal region, most severe the next day; and headache. The following symptoms have occurred in people who are very susceptible—sickness and vomiting (six times); fainting (once); meteorism (once); herpes (seven times); stomatitis (twice).

The temperatures were taken in over 100 cases at short intervals after an injection, and morning and evening for three days. From the results the conclusion was drawn that the fever is not caused by trypanolysis, that the initial rise may be due to antimony, but the later rises are probably due to the saline solution.

Observations made to determine the time required for an intravenous injection of antimony to clear the glands of trypanosomes showed this to be twenty minutes.

The rest of the paper deals with the successful treatment of yaws by the same method.

[The author does not state how long his cases were under observation after treatment. This information will doubtless be given in the later report.]

A. G. B.

Gamble (Mercier). **Sleeping Sickness in the Portuguese Congo: Apparent Cures.**—*Jl. Trop. Med. & Hyg.* 1913. Mar. 15. Vol. 16. No. 6. pp. 81-84.

Between December 1908 and August 1909 the author had 41 unselected native patients under treatment for trypanosomiasis, the parasites having been found, by gland puncture, in each case. The main treatment consisted in the administration of 100 grains of atoxyl subcutaneously in the fore-arms, usually in doses of 4 grains daily. The patients submitted to treatment voluntarily and lived at their own expense. A few had treatment subsequent to August 1909. Nineteen of the 41 are alive and well. Details of each case in which recovery appears to have taken place are given, with photographs of some of the patients. It is stated that all the nineteen are living useful lives and have had good health from three and a half to four years. The method of treatment, however, takes up much time. Since October 1910 the author has given as a rule seven and a half grains of atoxyl twice a week intramuscularly. He hopes to report on these cases later.

A. G. B.

v. d. Hellen. **Ueber den Zeitpunkt des Auftretens von Rückfällen der menschlichen Trypanosomiasis nach ihrer Behandlung mit Arsenophenylglyzin.** [The Time of Appearance of Relapses in Human Trypanosomiasis after Treatment with Arsenophenylglycin.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1913. Apr. Vol. 17. No. 7. pp. 230-242.

This is a continuation of the observations of von Raven and Zupitza, made in the sleeping sickness camp in Togoland (see *Sleeping Sickness Bulletin,* Vol. 3, p. 256 and previous references). Von Raven showed that the dose of arsenophenylglycin must exceed 40 mgm. per kilo. body weight and that a dose greater than 60 mgm. per kilo. causes symptoms of poisoning. Of the patients in this camp 57 treated with atoxyl and 233 with arsenophenylglycin are considered here; nearly all were at an early stage of the disease. The following table (abbreviated) shows their condition at the end of May 1912.

No. treated.	Still in camp.	Discharged as apparently well.	Time between last dose and last examination.	Relapsed.	Died of other disease.	Fate unknown.
Atoxyl, 15–20 double injections every 10th and 11th day, up to 0·5 gm. each.						
57	—	29=51 °/₀	31–40 mths.	16=28 °/₀	5=9 °/₀	7=12 °/₀
Arsenophenylglycin, two injections on successive days.						
233	58=25 °/₀	136=58 °/₀	9–35 mths.	29=12 °/₀	8= 4 °/₀	2=1 °/₀

Another table shows the duration of observation of the 58 arsenophenylglycin treated patients still in camp. About 40 of these have been under observation between seven and ten months and are shortly to be discharged. The 136 which have already been discharged are all in apparent health. It is noted that not a single one of these had a relapse; the relapses all occurred in the camp a short time after cessation of treatment. This was not the case with atoxyl treatment, for of sixteen relapses fourteen occurred amongst discharged persons who were apparently well. Another table shows how many months the 136 discharged persons were under observation in camp. It is seen that 79 were there from nine to twelve months and 61 from thirteen to nineteen months after the arsenophenylglycin injections.

The 29 cases of relapse are divided into twenty in whom trypanosomes were found and nine whose deterioration was clinical. Since the end of 1908 regular observations have been made of the temperatures of all the patients, at first three times a day and then morning and evening. A table gives a full account of the temperature and other observations made on the above twenty cases. The author thinks that the beginning of relapse should be dated to the first day of fever after the administration of the drug if there is no other cause of a rise. In these cases the earliest relapse so detected was at fifteen days, the latest at six and one third

months. In three cases it occurred in less than a month, in nine between 1 and 2 months, in six between 2 and 3 months, in one between 3 and 4 months and in one between 6 and 7; that is to say, in 95 per cent. of cases it occurred within the first four months. The longest period which elapsed between two suspicious temperatures was 141 days. Another table shows that the time of the relapse is independent of the size of the dose. The temperature, when the presence of trypanosomes was detected, varied between 37·5° and 39·0°. The author regards 37·4° as the critical temperature. If this or a higher temperature is found, the blood is microscopically examined.

The conclusions drawn are that, if one is to be sure of the results, persons treated should have their temperatures watched for at least seven months and any whose temperature rises above 37·4° without obvious cause should be kept under observation for at least five months longer.

A. G. B.

Aubert (P.) & Heckenroth (F.). **L'Atoxyl dans la "Prophylaxie Chimique" de la Trypanosomiase Humaine.**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 184-189.

The authors think that we should distinguish clearly between two kinds of treatment which, although the same therapeutic substances are used, differ in their object. The object of curative therapy is, by prolonged treatment, to obtain definitive cure. The natives generally refuse treatment of this kind. Prophylactic therapy, on the other hand, is a form of treatment the purpose of which is only to banish the trypanosomes from the peripheral circulation for as long a period as possible. This means a short course of treatment and is well accepted. The patients cleared of their parasites no longer form reservoirs of the virus and cease to be dangerous to the rest of the population.

In this paper observations are given of infected natives who received a varying number of injections of atoxyl and whose blood was submitted to frequent examination with the centrifuge. Of 148 persons at Carnot who received a single injection of atoxyl and were carefully examined six months later 75 per cent. showed no trypanosomes. [It is not stated whether more than one examination was made.]

Tables are given of patients who received at Brazzaville injections of atoxyl varying in number (1) from one to four, (2) from five to six, (3) from seven to fourteen. The usual dose was 1 gm. In (1) 23 patients were treated; the average period of sterilisation of the blood was six months; and the number of patients so sterilised was twelve, that is 52 per cent. [There is a slight discrepancy between this statement and the table.] In (2) nine patients were treated; the average period of sterilisation was nine months; the number of patients so sterilised was four, that is, 44 per cent. In (3) the number of patients treated was eleven; the average duration of sterilisation was thirteen months; the number of patients so sterilised was ten, that is 90 per cent. Of a total number of 194 patients treated the blood of 141 was sterilised for six months or more, that is 72 per cent.

The authors conclude that in the majority of cases prophylactic treatment, consisting of four or five atoxyl injections at the usual intervals, suffices to secure an average duration of sterilisation of eight to ten months. The treatment should be repeated. It may be carried out at medical posts or in the course of tours made by medical officers and can be applied systematically to all infected natives.

[These are striking results, but had the blood of these persons been injected into susceptible animals the percentage of sterilisations might have been less. Previous work too tends to show that apparent absence of parasites from the blood stream does not mean that the subject is non-infective to fly.]

A. G. B.

Transmission.

Brumpt (E.). **Evolution de *Trypanosoma lewisi, duttoni, nabiasi, blanchardi*, chez les Puces et les Punaises. Transmission par les Déjections. Comparaison avec *T. cruzi*.**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 167-171.

T. lewisi is easily transmitted from rat to rat by fleas and less easily by lice. The cycle in the flea has been described by Minchin and Thomson. The blood trypanosomes become transformed in the digestive tube of fleas of various species* into crithidia and sometimes into herpetomonas or leishmania. These divide actively and give origin after a variable number of days to small trypanosomes which are infective to the rat and which Brumpt proposes to call 'metacyclical' trypanosomes. As to the method by which the infection is conveyed Brumpt's transmission experiments, made with swallow fleas, agree with those of Nöller; he finds that transmission is effected exclusively by the dejecta or by the rectal contents of the fleas, provided they contain metacyclical trypanosomes. He has got only negative results from biting experiments when the dejecta were sterilised on the rat's skin. The small trypanosomes contained in the dejecta are in their morphology and their aptitude for penetrating mucous membranes quite different from the blood forms of *T. lewisi*. Employing the rectal contents and dejecta of five fleas which had bitten, without infecting it, a young rat still suckled by its mother, he was able to infect three of the same litter by putting some of the infected fluid in the eye, mouth, and peritoneum. Experiments made with controls, blood trypanosomes being placed in the eye, mouth and on the skin, were negative.

T. lewisi develops also in the bug, *Cimex lectularius*. In one instance he was able to infect a rat by inoculating it with the rectal contents of a bug which had become infected 38 days and again six days before. He states that there was certainly a cyclical development in this bug. With regard to the observations of Patton and Wenyon on Leishmania and bugs, he holds

* *Ceratophyllus fasciatus*, *C. hirundinis*, *Ctenophthalmus agyrtes*, *C. canis*, *Ctenopsylla musculi*, *Pulex irritans*, and *Pulex* sp. *? braziliensis*.

that the non-success of the former in transmission was due to the fact that he did not inoculate the dejecta of the infected bugs. He believes that Mediterranean kala azar is probably transmitted by the dejecta of fleas either by the alimentary canal (? sucking of the bitten skin) or by skin contamination.

Trypanosoma rabinowitschi of the hamster develops, according to NÖLLER, in the rectum of the hamster flea, as well as in *Ceratophyllus fasciatus* and in *Ctenocephalus canis*. The small metacyclical trypanosomes are found in the rectal pouch.

Trypanosoma nabiasi (syn. *T. cuniculi*) develops exclusively, according to Brumpt's experiments [details not given] in the rabbit flea; its cycle is identical with that of *T. lewisi* and metacyclical rectal forms are found. There is no development in the bug.

Trypanosoma blanchardi of the dormouse develops in the dormouse flea; the development, according to the author's observations, is identical with that of *T. lewisi* and *T. nabiasi*; it takes place in the large intestine. Metacyclical trypanosomes live in the rectal pouch and are found in the dejecta. This trypanosome does not develop in the swallow flea nor in the bug.

T. duttoni of the mouse develops in the swallow flea in the same way as the preceding; also apparently in the bed-bug. Eleven mice, three or four days old, were the subjects of experiment. Seven received in the mouth the rectal contents of seven fleas and all became infected. One mouse received in the rectum dejecta containing metacyclical *T. duttoni*; the result was negative. Another mouse inoculated under the skin did not become infected.

The author sums up these observations—

(1) All the trypanosomes of small rodents seem to develop in the same way in fleas, some in one species, others in many.

(2) Metacyclical trypanosomes no longer multiply; they are in a waiting stage (*phase d'attente*) comparable with encysted forms of *C. melophagia** or herpetomonas.

(3) The trypanosomes of small rodents develop in the posterior intestine and are evacuated with the dejecta, with which alone vertebrates become infected.

(4) The trypanosomes which develop in the fleas are clearly primitive parasites of fleas. They differ from the crithidia and herpetomonas found in a number of fleas only by the formation of metacyclical trypanosomes instead of the cysts formed by the said crithidia and herpetomonas.†

(5) The trypanosomes of *lewisi* type, although morphologically identical as regards blood and metacyclical forms, are 'natural' species and consequently good species, since in nature they are transmitted only to the host which harbours them.

A. G. B.

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* The author calls this parasite *Trypanosoma melophagi* Flu, but reference to FLU'S original paper shows that the name given was *Crithidia melophagia.* (*Archiv. f. Protistenkunde.* 1908. Vol. 12. p. 147.)

† In a foot note Brumpt says that he has named the parasite discovered by NÖLLER in *Ctenocephalus canis Herpetomonas pseudoleishmania.* Dr. FANTHAM points out that in July 1912 (see *Brit. Med. Jl.* Nov. 2 1912) he named this parasite *H. ctenocephali.* Brumpt's name therefore cannot stand.

Brumpt (E.). **Immunité Partielle dans les Infections à *Trypanosoma cruzi*, Transmission de ce Trypanosome par *Cimex rotundatus*. Rôle Régulateur des Hotes Intermédiaires. Passage à travers la Peau.**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 172-176.

The author made experiments to ascertain if the virus of *T. cruzi* from Bahia was identical with that isolated by Chagas. Nineteen mice which had been severely infected in May 1912 with the virus of Bahia were inoculated in December with considerable doses of the Chagas virus, at the same time as thirty controls of the same age. The results showed that a previous attack with the Bahia virus confers a fairly good resistance to large doses of the Chagas virus.

The author made several experiments with bugs, *C. lectularius* and *C. rotundatus*, to see how the exalted virus of Chagas behaved after it had been through intermediate hosts. These two species of bugs became infected in a proportion of 80 per cent., their dejecta containing 'metacyclical' trypanosomes. These were injected into young mice. The result was that the mice contracted very light infections and recovered in a few days. The exalted virulence had fallen to the natural and resembled that of the virus of Bahia. The author suggests that *C. rotundatus*, which is the bed-bug of Brazil and other tropical regions, may play as important a part in nature in the transmission of *T. cruzi* as *Conorhinus megistus*. Experiments tended to show that in the former species this trypanosome would die out in France during the winter.

The author found that the metacyclical trypanosomes of this species have considerable power of penetration; when they were placed in the mouth or rectum of young mice these were surely infected. There was one instance of infection through the skin. He suggests that man becomes infected through the mucosa of the mouth. The Conorrhinus as a rule bite the face or the lips of sleeping persons; after or during their feed they often drop abundant dejecta which may come in contact with the mucous membrane.

The author refers to Gonder's experiment showing that a strain of *T. lewisi* resistant to arsenophenylglycin loses its resistance after passage through the rat louse. The fact that in the passage through the invertebrate host all the physiological characters acquired in the laboratory are lost makes many laboratory experiments lose their value. Parasites inoculated by intermediate hosts differ both morphologically and physiologically from those which are inoculated from vertebrate to vertebrate. For example, the small metacyclical *T. lewisi* pass easily through the mucous membrane of young rats, whilst the blood forms only exceptionally do so. The fact that various animals are artificially susceptible to a virus does not prove that they can be infected in nature by means of an intermediate host. Secondly, it has been demonstrated that in the laboratory one can infect mice with *T.*

lewisi; in nature it is not so. The author has looked in vain for trypanosomes in wild mice living in the same locality with infected rats. Probably the metacyclical trypanosomes of invertebrates have not the same infective properties as the blood trypanosomes.

A. G. B.

Trypanosome Infections of Wild Animals and of Stock.

Bruce (David), Harvey (David), Hamerton (A. E.), Davey (J. B.), & Lady Bruce. **The Trypanosomes found in the Blood of Wild Animals Living in the Sleeping-Sickness Area, Nyasaland.**—*Proc. Roy. Soc.* 1913. Apr. 7. Series B. Vol. 86. No. B 587. pp. 269-277.

The camp of the Royal Society's Commission is situated on one of the hills that rise near the western edge of the flat country adjoining Lake Nyasa. This flat country extends some 20 miles inland and the camp is about ten miles from its edge. The plain is covered with thorn scrub, which is the home of the tsetse fly and also of numerous wild animals. When an animal was shot on this plain by a member of the Commission, thick and thin films of blood were made and a specimen in a bottle with citrate of soda was sent speedily to the camp where it was injected into a goat, a monkey, and a dog. A table shows the result of the examination of 180 specimens of wild game or other animals shot in this area, chiefly from June to September; it is about 50 miles by 25 and is in the heart of the sleeping sickness area in Nyasaland. 57 animals were found to harbour pathogenic trypanosomes, that is 31·7 per cent. Another table gives the species of trypanosomes found in the 180 animals. The authors note that the human trypanosome of Nyasaland agrees in all respects with *Trypanosoma brucei* except as regards the presence of posterior nuclear forms. They write:—

"In order to compare the two species of trypanosomes more closely, the Commission procured, by the kindness of Dr. A. Theiler, C.M.G., Pretoria, a strain of Nagana from the same spot in Zululand where it was first discovered in 1894. Much to the surprise of the Commission it was found that *T. brucei* has quite as large a proportion of posterior-nuclear forms as *T. rhodesiense*, and that the blunt-ended character is common to both species. The Commission is therefore driven to the conclusion that *T. rhodesiense* is neither more nor less than *T. brucei*, and that the human trypanosome disease of Nyasaland is Nagana.

"To this it may be objected that Nagana has never been known to attack human beings. This has probably been due to faulty diagnosis, cases in man being returned as malaria."

The pathogenic trypanosomes found were *T. brucei* (Plimmer and Bradford) vel *rhodesiense* (Stephens and Fantham) (14 times), *T. pecorum* (26 times), *T. simiae* (3 times), *T. caprae* (Kleine) (20 times), and *T. ingens* (3 times); the last is probably not pathogenic.

Table 5.—The Species of Animals dealt with, the Total Number examined, the Number found Infected, and the Species of Trypanosomes by which they were Infected.

Animal.	Total No. examined.	No. found infected.	*T. brucei* vel *rhodesiense.*	*T. pecorum.*	*T. simiae.*	*T. caprae.*	*T. ingens.*
Eland ...	10	6	—	6	—	1	—
Sable ...	5	0	—	—	—	—	—
Waterbuck...	13	9	3	1	—	8	—
Koodoo ...	3	2	—	2	—	—	—
Bushbuck ...	10	7	—	7	—	1	—
Hartebeeste	35	6	5	1	—	—	—
Reedbuck ...	19	12	3	1	—	9	1
Oribi ...	26	4	1	1	—	1	1
Duiker ...	7	2	1	—	—	—	1
Buffalo ...	9	2	—	2	—	—	—
Lion ...	1	0	—	—	—	—	—
Hyaena ...	3	2	—	2	—	—	—
Elephant ...	2	0	—	—	—	—	—
Warthog ...	33	7	1	3	3	—	—
Wild Cat ...	3	0	—	—	—	—	—
Porcupine ...	1	0	—	—	—	—	—
Total ...	180	59	14	26	3	20	3

From this and the following table it is inferred that in this fly district the waterbuck, hartebeest, reedbuck and duiker are dangerous enemies to man; the eland, kudu, bushbuck and buffalo to cattle, goats and sheep; and that the warthog is the only animal which harbours *T. simiae,* the "lightning destroyer" of the domestic pig.

The conclusions are as follows:—

"1. 31·7 per cent. of the wild game in the fly-country below Kasu Hill harbour pathogenic trypanosomes.

"2. The species of trypanosomes found are *T. brucei* vel *rhodesiense* 7·8 per cent., *T. pecorum* 14·4, *T. simiae* 1·7, *T. caprae* 11·1, and *T. ingens* 1·7.

"3. It is self-evident that these wild animals should not be allowed to live in "fly-country," where they constitute a standing danger to the native inhabitants and the domestic animals. It would be as reasonable to allow mad dogs to live and be protected by law in our English towns and villages. Not only should all game laws restricting their destruction in "fly-country" be removed, but active measures should be taken for their early and complete blotting out.

"4. It must be strictly borne in mind that this only refers to wild animals living in fly-areas. No pathogenic trypanosomes have, up to the present, been found by the Commission in the blood of animals living in fly-free areas."

[These results confirm and extend those obtained by KINGHORN and YORKE in the adjoining country of Northern Rhodesia. (*Annals of Tropical Medicine,* 1912, Vol. 6, pp. 483-493, and this *Bulletin,* No. 9, p. 516.)]

A. G. B.

Balfour (Andrew). **Animal Trypanosomiasis in the Lado (Western Mongalla) and Notes on Tsetse Fly Traps and on an Alleged Immune Breed of Cattle in Southern Kordofan.**—*Ann. Trop. Med. & Parasit.* 1913. Mar. 31. Vol. 7. No. 1. pp. 113-120. With 2 plates.

In May 1912 the author visited the sleeping sickness camp at Yei, in what is now known at Western Mongalla, the name Lado having disappeared. He had a few opportunities of examining the blood of transport and other domestic animals. From the blood, sent to him, of three transport bulls a trypanosome was obtained of *pecorum-nanum-congolense* type. 140 parasites were drawn and measured and the results plotted on a chart. The curve is found to answer very closely to that for the Sudan *T. nanum*. The trypanosome is short and has no free flagellum. Its average length is 12·6 microns, minimum 9·8, maximum 17. Its appearance is shown in microphotographs. A dog inoculated with the strain showed trypanosomes for a time. It is uncertain whether the infection was contracted in Western Mongalla. Trypanosomes obtained from infected mules were measured and plotted in the same way. The average length was 17·6 microns, minimum 10·5, maximum 28. These also are figured. The trypanosome is of *brucei* or *gambiense* type and is dimorphic. A marked feature is the frequent occurrence of an unstained area, usually of spherical shape, in the neighbourhood of the blepharoplast. A curve is given showing two apices, but only a hundred trypanosomes could be drawn.

2. The author has previously drawn attention to the subject of tsetse fly traps (see *Sleeping Sickness Bulletin*, Vol. 4, p. 309). He has had large traps constructed by the Andres Maire Company. One is shown in a figure. Ranken is to take two of these traps with him to Yei and carry out experiments. The following measures will be tried:—

1. Soaking the central bands or wicks in a mixture of water and either human or animal sweat.
2. Placing a live animal in the trap.
3. Soaking the central bands in citrated blood and at the same time hanging in the trap a piece of fresh meat with the skin still adhering.
4. Soaking the bands as above and having in addition a tube of citrated blood arranged according to the ingenious device of Rodhain and his colleagues (see this *Bulletin*, No. 3, p. 124).

3. A photograph is given of a bull of the small black breed found in Southern Kordofan. This breed is said to be immune to trypanosomiasis and is the only breed which can live in the infected Koalib area where *G. morsitans* abounds and conveys an infection due, Balfour believes, to *T. brucei*. He notes that an apparently similar breed exists in Northern Nigeria [figured opposite p. 26 of the same *Annals*]. The effect of the blood serum of this bull is to be tested on various trypanosome strains.

A. G. B.

Macfie (J. W. Scott). **Trypanosomiasis of Domestic Animals in Northern Nigeria.**—*Ann. Trop. Med. & Parasit.* 1913. Mar. 31. Vol. 7. No. 1. pp. 1-20. With 3 plates.

The author gives instances of the grave nature of the losses occasioned by trypanosomiasis of domestic animals in the south-west portion of Northern Nigeria, in the province of Ilorin. Cattle, sheep and goats are usually slaughtered when they become sick. The table shows the infecting agent in 86 cases of naturally acquired trypanosomiasis. Reference is made to that published in the *Sleeping Sickness Bulletin* (Vol. 3, p. 422) when the identifications were made by Sir David Bruce.

Table II.—Showing the infecting agent in eighty-six cases of naturally acquired trypanosomiasis in domestic animals in Northern Nigeria.

Host.	*T. brucei.*	*T. vivax.*	*T. nanum* or *T. pecorum.*	*T. theileri.*	Double infections.
Horse	14	18	8	—	3
Donkey	2	2	—	—	—
Cattle—					
Fulani breed ...	1	18	1	—	1
Dwarf breed ...	—	2	—	1	—
Sheep and ram ...	1	8	1	—	—
Goat	—	4	—	—	—
Dog	—	1	—	—	—
Totals ...	18	53	10	1	4

The morphological characters of the trypanosomes found in blood films had to be relied upon for identification.

T. brucei.—A trypanosome which closely corresponded with the type described and figured by Bruce and others as *T. brucei* was found in twenty cases of natural infection. It is suggested in a foot-note that this trypanosome is probably that for which Stephens and Blacklock have recently proposed the name *T. ugandae.* In three horses and one donkey posterior nuclear forms were detected, and in guinea-pigs and rats inoculated from them appeared at certain stages of the disease in relatively large numbers. Of eleven horses and two donkeys suffering from this form of trypanosomiasis none recovered. All the cases in which posterior nuclear forms were observed were of acute type.

T. vivax.—This parasite occurred in 56 of the 86 cases. From the fact that it was found in the dog, the author writes, it is probable that this parasite is that to which Ziemann gave the name *T. vivax* and not the allied *T. cazalboui* described by Pecaud as occurring in Dahomey in horses. It is difficult to say what would be the fate of cattle, sheep, and goats because they are slaughtered to anticipate death.

The author notes that *G. palpalis* and *G. tachinoides* are distributed throughout the province, and *G. submorsitans* and *G. longipalpis* are restricted to one division of it; 24 of the animals, infected with one or other of the three types, had never been in this division.

A chart is given of the rainfall and the number of admissions of horses to the isolation camp at Zungeru for 1911; it tends to show that trypanosomiasis increases with the rains. The author states that no immunity follows an attack of trypanosomiasis, reinfections with the same or different species of trypanosome being met with. The dwarf cattle mentioned by Foy and by Pollard were found by Macfie to be tolerant of *T. vivax*, but one succumbed to a large injection of *T. brucei*. A tabular synopsis is given of the cases observed, and photographs of infected animals and of the dwarf cattle.

In the summary it is stated:—

"*T. vivax* is the most common form [of trypanosome] at any rate in the south-western portions of the Protectorate, being present in fifty-five out of eighty-four cases collected in Ilorin province, the Niger province, and at Lokoja.

"Of twenty Fulani cattle treking down towards the coast from the provinces of the north, and found to be suffering from trypanosomiasis, eighteen harboured *T. vivax*.

"In horses *T. vivax* produces a much less serious disease than *T. brucei*. Of fifteen cases infected with *T. vivax*, of which the records are complete, fourteen recovered. Of eleven cases infected with *T. brucei* none recovered."

A. G. B.

Bruce (David), Harvey (David), Hamerton (A. E.), Davey (J. B.), & Lady Bruce. **Trypanosome Diseases of Domestic Animals in Nyasaland. II.** *Trypanosoma caprae* **(Kleine).**— *Proc. Roy. Soc.* 1913. Apr. 7. Series B. Vol. 86. No. B 587. pp. 278-284. With 1 plate.

Trypanosoma caprae belongs to the vivax group which consists of three species (*T. uniforme*, *T. vivax* and *T. caprae*). They are harmless to the smaller laboratory animals, monkeys and dogs. They develop in the proboscis of tsetse flies. *T. caprae* is transmitted by *Glossina morsitans*.

The morphology of *T. caprae* is described in detail, as seen in living and stained preparations. The average length of 500 specimens of the parasite was 25·5μ, the trypanosomes being measured from waterbuck (20), ox (40), goat (260) and sheep (180). The maximum length was 32μ, the minimum 18μ. The breadth averaged 3μ. A chart shews the distribution in respect to length of 500 individuals of *T. caprae*, Nyasaland. The curve is that of a monomorphic trypanosome with a peak at 25μ.

"*T. caprae* differs from *T. vivax* in that it is heavier built and altogether has a larger and clumsier appearance" . . . . "There is a well marked free flagellum which averages 6·5μ in length.'

"In goats and sheep . . . *T. caprae* runs a fairly fatal course." It is "not of much pathological importance as far as oxen are concerned."

The host or reservoir of *T. caprae* is the "wild game" (reedbuck, waterbuck, eland and bushbuck). 10·5 per cent. of the wild game examined contained the trypanosome.

Tables give the dimensions of the trypanosomes measured and various details as to the animals inoculated. The paper is illustrated by a coloured plate.

H. B. F.

UNCLASSED.

PONSELLE (A.). **Recherches sur la Culture in Vitro du Trypanosome de l'Anguille (*Trypanosoma granulosum* Laveran et Mesnil, 1902). Une Nouvelle Modification au Milieu de Novy et MacNeal.**—*Compt. Rend. Soc. Biol.* 1913. Feb. 21. Vol. 74. No. 7. pp. 339-341; & Mar. 14. No. 10. pp. 522-524.

The author has succeeded in maintaining *Trypanosoma granulosum* of the eel for some time on the Nicolle and Mathis modifications of the Novy-MacNeal medium, but the parasites only resemble those in the blood of the eel, and no developmental cycle was obtained. Recently on a modification of the N.N. medium he has obtained a development of *T. granulosum* similar to the stages found in the alimentary canal of the leech, *Hemiclepsis marginata*. The formula of the medium is:

Unwashed gelatine ...	...	20 grammes.
Ordinary water ...	...	1,000 cc.

The gelatine, melted and filtered, is placed in tubes, 2 to 3 cc. per tube, and then sterilized. After cooling to about 50°, it is mixed with its own volume of defibrinated rabbit's blood and allowed to solidify in sloped tubes. Inoculation is made, with the uncitrated blood of the eel, into the liquid of condensation. The special characteristic of the medium consists in the complete suppression of sodium chloride, which makes the solution very hypotonic to the blood of vertebrates.

In the later paper the author reports that *Trypanosoma granulosum* has now succeeded in a series of four passages, the fourth successive series of test tubes having been inoculated and yielding cultures of crithidial forms that multiplied actively. There are 17 text figures of these various cultural forms.

One eel, considered to be uninfected, was inoculated subcutaneously with two drops of a primary culture nine days old. Seven days later a few trypanosomes were present in the blood; on the 13th day they were still more rare. A second inoculation experiment on another eel, however, failed. The author states that one cannot be certain that the first eel did not harbour trypanosomes that were extremely rare at the time of incubation. Further experiments with elvers, which are usually without trypanosomes, are to be undertaken in May.

T. phoxini, *T. tincae* and *T. lewisi* also have been cultivated on Ponselle's modification of the Novy MacNeal medium, but a successful culture of *T. brucei* has not been obtained.

H. B. F.

Uhlenhuth (Paul) & Emmerich (Emil). **Ueber das Verhalten des Kaninchenhodens bei experimenteller Trypanosomen- und Spirochäteninfektion.** [The Behaviour of the Testes of the Rabbit in Experimental Infections with Trypanosomes and Spirochaetes.]—*Deut. Med. Wochenschr.* 1913. Apr. 3. Vol. 39. No. 14. pp. 642-644.

Experiments by Uhlenhuth and Mulzer have shown that one can produce in the testis the first visible signs of infection with syphilis, not only by direct inoculation into that organ, but sometimes also by the injection of infected material into the blood. The testis of the rabbit in fact forms for *Spirochaeta pallida* a culture apparatus in vivo, as Uhlenhuth has expressed it. The testis plays a similar part in certain other infections, as in experimental glanders in the guinea-pig, trichophyton disease in the rat, as well as mumps and smallpox in man. The authors determined to make similar experiments with trypanosomes.

Dourine.—In the full-grown guinea-pig this disease takes a slow course as a chronic tissue infection, trypanosomes being found sparingly in the blood. A rabbit received in both testicles an injection of blood from an infected mouse. After some days both the organs were enlarged and a testis puncture a week later showed numerous trypanosomes, whereas none were present in the blood. From the same mouse a second rabbit was injected intravenously; this also a week later showed a swelling of the testes and numerous trypanosomes in the puncture fluid, while the blood was negative. In a third case in which the rabbit received the injection in the peritoneum trypanosomes appeared first in the blood, but later they were found in the testes when they had disappeared from the blood. In another experiment in which trypanosomes were introduced into one testis they were found a week later in the other. They are demonstrable in this organ in large numbers at every puncture. Experiments are detailed in which they appeared three days after the injection had been made. The authors suggest that the natural disease in the horse might be diagnosed in this manner.

Experiments were next made with *Trypanosoma brucei*. Trypanosomes were to be found only for a short time in the testes, even when introduced by that channel, and only once did they appear, temporarily, in that organ when they had been introduced into the blood.

Experiments with *Trypanosoma lewisi* were negative.

Trypanosoma gambiense.—The strain used was from a guinea-pig. The experiments are detailed. The results were similar to those of the dourine experiments. The trypanosomes in a short time undergo enrichment in the testes and occur there at an earlier period than in the blood of control mice. The authors suggest that it would be of value to ascertain if such an enrichment is observed when the blood of sleeping sickness patients is injected into rabbit's testes.

A. G. B.

LAVERAN (A.) & ROUDSKY (D.). **Essais d'Immunisation contre les Trypanosomes pathogènes.—Trypanotoxines.**—*Bull. Soc. Path. Exot.* 1913. Mar. Vol. 6. No. 3. pp. 176-181.

BRAUN and TEICHMANN succeeded in immunising mice, rats, guinea-pigs, and rabbits against several pathogenic trypanosomes, especially *T. brucei*, by one of the following procedures—(1) By injecting into the peritoneal cavity of the animals to be immunised dried and powdered trypanosomes suspended in salt solution; (2) By immunising rabbits with the dried trypanosomes and introducing their serum into the peritoneal cavity of mice. The vaccinated animals are tested with a strain of low virulence.

The authors have followed almost exactly the technique employed by BRAUN and TEICHMANN, but ceased to use toluene because they found it very poisonous; they obtained good results with the powder prepared aseptically. The trypanosome used for the experiments was the *T. brucei* of nagana (Ferox of EHRLICH). The powder was first used on eight mice with the same number of controls, then on two rabbits with one control, and lastly the serum of rabbits treated with dried trypanosomes was injected into three mice with the same number of controls. All these experiments were entirely negative. The rabbits and mice treated with the powder were not immunised against nagana; the development of the infection was not even delayed in them. The serum of the treated rabbits was quite inactive. They remark too that the process is hardly practicable. For these few experiments they were obliged to kill 100 large rats.

According to BRAUN and TEICHMANN, *Trypanosoma brucei* contains no toxin. The authors do not agree. They refer to experiments recorded in a previous paper (see *Sleeping Sickness Bulletin*, Vol. 3, p. 132) and give the details of two fresh ones. In the first a white mouse which received 6 cgm. of *T. brucei* powder became very ill, but eventually recovered. In the second instance after the same dose a white mouse died with subnormal temperature. They say that these results were always obtained, and show that a trypanotoxin exists.

A. G. B.

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